for . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING AND VENTILATING

The Air Conditioning Monthly

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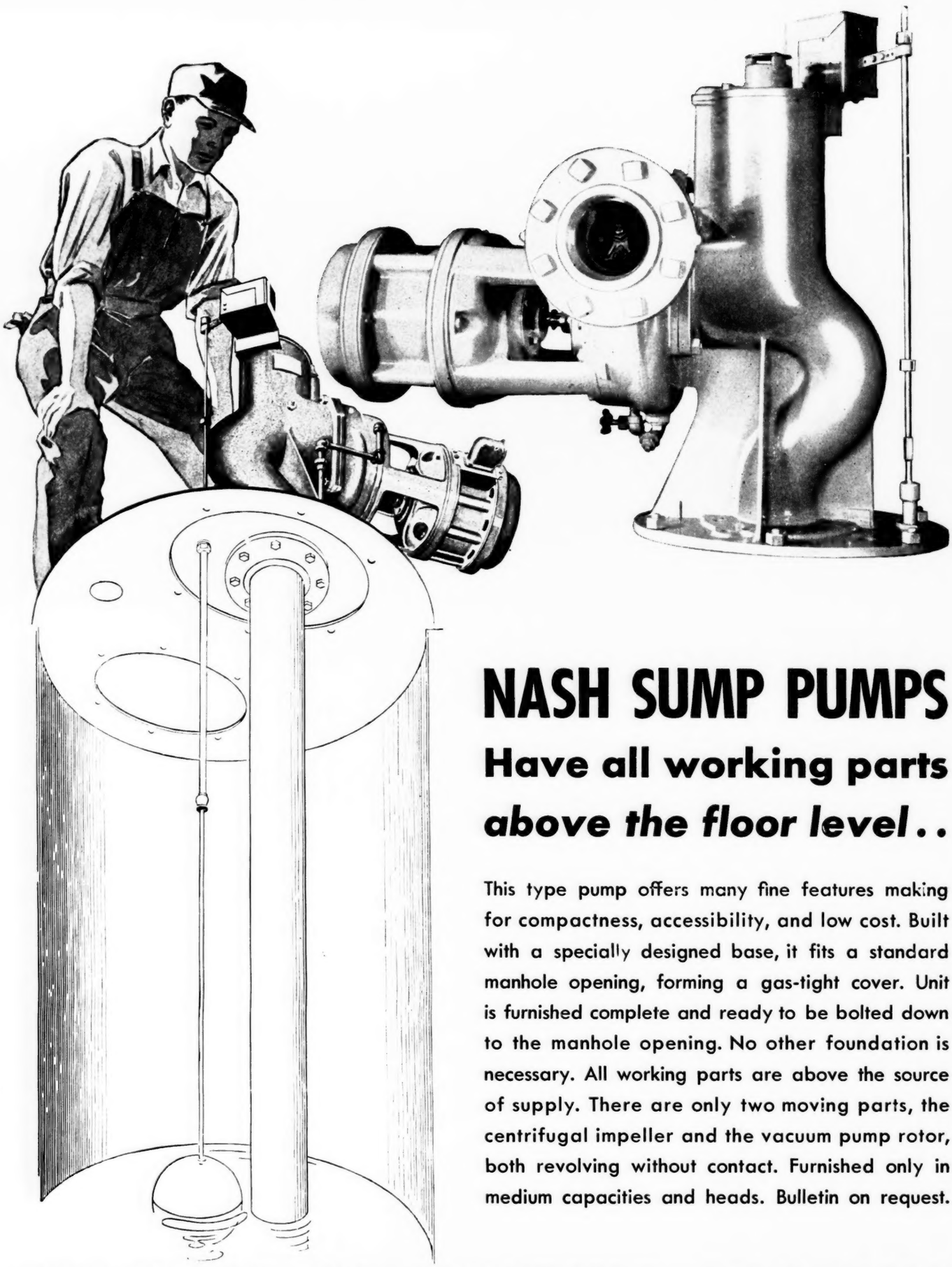

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THE NASH ENGINEERING COMPANY

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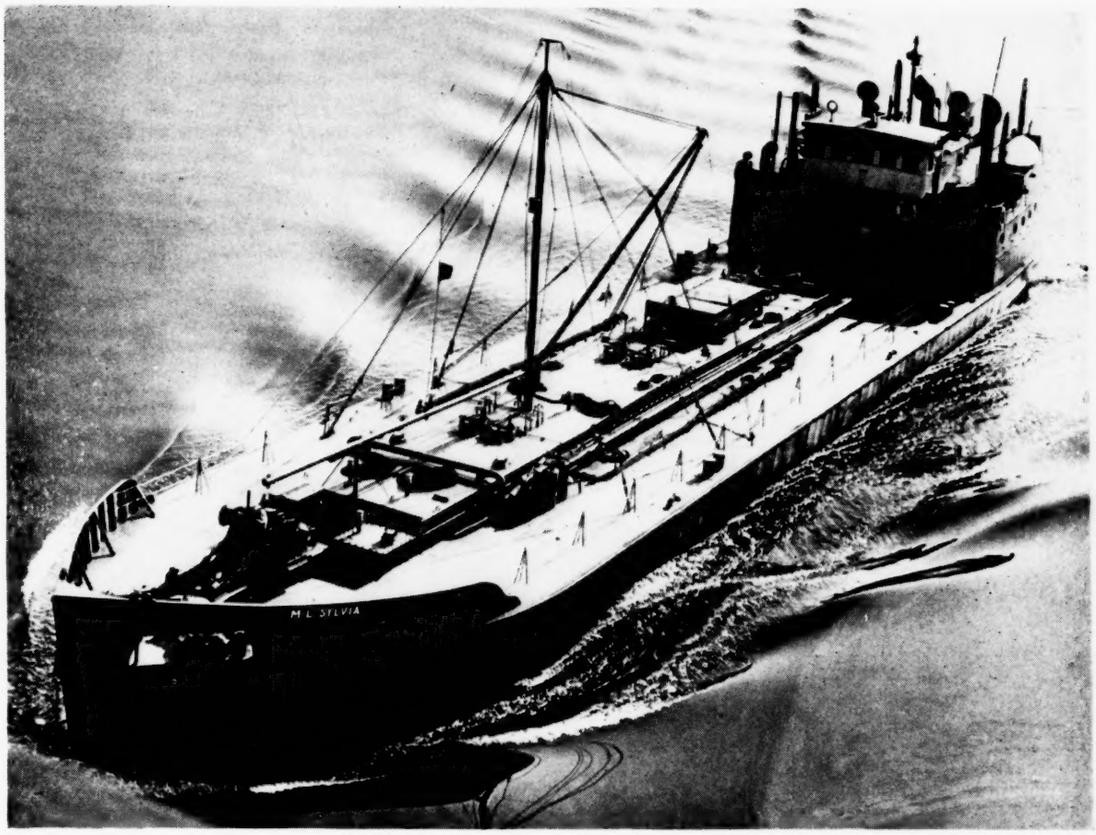


"85% of this oil.... was brought to Seaboard ports by tankers...."

Will There Be an Oil Shortage Along the Eastern Seaboard?

The threatened fuel oil shortage along the Eastern Seaboard has been a major topic of conversation among heating men and oil burner users for over a month. This article reviews the history of the oil scare, presents statements from the different groups involved, and summarizes the evidence (as of July 1) on both sides of the question.

FIRST, it must be emphasized that the currently threatened fuel and gasoline shortage affects only two areas — Atlantic Seaboard states east of the Appalachians, and the western portions of Oregon and Washington. All other areas are amply served by truck, rail and pipeline facilities; second, there is not, at the present time, any shortage in oil production. The problem is primarily one of transportation; third, in the affected areas there is no shortage of oil *now*, so that summer storage of fuel oil by homeowners is suggested. The individual who stocks up now will be contributing additional storage capacity needed during the next few months.

Although just about every possible individual and group have made statements, speeches or addresses on the fuel oil and gasoline situation, the oil companies have had little to say with this exception: They insist that they are able to produce the oil. Attention is thus immediately focused on transportation, especially tankers.

It is estimated that in 1940 somewhat over 162,000,000 barrels of crude oil, 119,000,000 barrels of gasoline, and 45,000,000 barrels of domestic heating oils were transported up the eastern coast. Thus approximately 14% of the petroleum products carried to the Eastern Seaboard were for domestic heating purposes. Over 85% of this oil and gasoline in the past was brought from the Gulf to Seaboard ports by tankers variously estimated to number between 260 and 325, so that each of these tankers delivered at the rate of about 4000 barrels per day in order to meet the East's petroleum requirements.

Late in May the government suddenly announced that 50 of the tankers had been taken from Gulf-Seaboard service and transferred to Aid-for-Britain service. This resulted in a decrease of tanker capacity in the neighborhood of 16% and indicated a possible oil shortage of about the same order. In addition 12 tankers now under construction by the oil companies were transferred by request of the government to the Navy and will go into government service as soon as they are completed.

There are reports to the effect that 50 more tankers are to be transferred some time in the future to British service.

Use of seized and interned Italian, German, Danish and French tankers has been suggested, and oblique references made to 100,000 tons of French-flag tankers in Martinique; it was not explained how these could be used short of seizing the French island.

On June 18, Petroleum Coordinator Ickes moved to increase the prospective supply of petroleum products for the East Coast by 5,000,000 bbl per year. Conferences between the Coordinator and officials of Sun Oil and Standard Oil of California resulted in a recommendation by Mr. Ickes whereby tankers now engaged on routes between California and East Coast ports will be switched to runs between Gulf ports and the East Coast.

On June 26 the Coordinator acted again. Operators of the tanker fleets were asked to have made immediately, a thorough and searching examination of the daily performance of each tanker to the end that some improvement can be made in performance.

"All avenues for increasing the East Coast's supply of petroleum products, so as to avert the impending shortage if possible, are being explored," the Coordinator said. He emphasized, however, that a severe shortage may develop in spite of all efforts.

Along the same line is a bill introduced into Congress, the so-called Load-line Bill, authorizing the loading of tankers to a greater depth than is now permitted. Almost assured of passage, the bill would permit some tankers to carry 5% more petroleum per trip than is now carried. Since some older tankers now carry capacity loads, it is anticipated passage of the bill will increase transportation facilities by 3%.

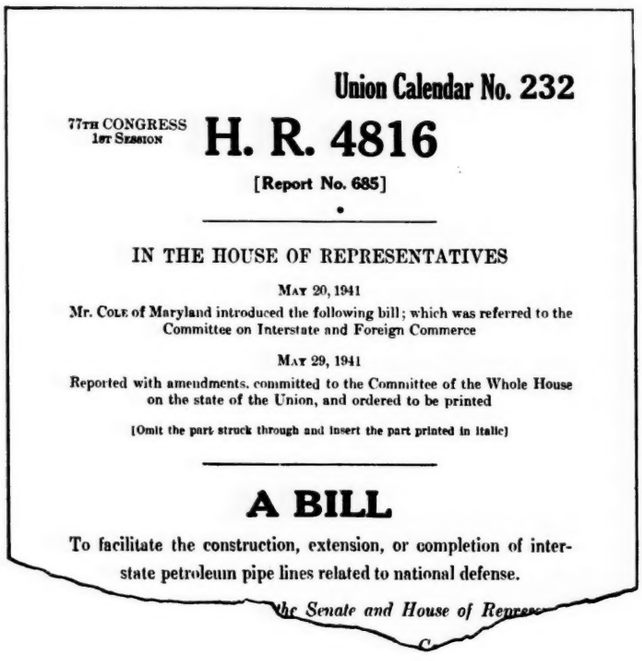
Pipe Lines

There are three major existing crude oil pipe lines already serving the Eastern Seaboard. One of these which has Eastern branches to Bayonne and Marcus Hook, originates in Texas and Oklahoma through several Western branches combining at Kansas City.

A second runs from the West Virginia oil fields to Marcus Hook and a third from Louisiana to the Carolinas. Additional pipe lines have been proposed in the past but for several reasons were never constructed. One reason was that the oil companies, due to their experience with the Department of Justice following NRA days, were unwilling to attempt construction of these lines. An additional reason was that pipeline companies do not have the right of eminent domain in a number of states and this has held up several projects. A third reason is that it is at least twice as costly to transport the oil from Gulf to East ports by pipeline as by tanker.

Passed by the House, awaiting action in the Senate is the Cole Bill to facilitate pipeline construction which would probably release projects costing nearly $160,000,000. The biggest of the poposed pipeline projects is a 15,000 mile double line from the Texas oil fields to Bayonne, as shown in the accompanying illustration. This would consist of a 24-in. crude oil line to cost $70 million, carry 250,000 bbl per day, permit the release of 65 tankers, and be completed in 12 to 15 months. Also expected is the private construction of an $8 million pipeline from Portland, Maine, to Montreal, to be completed by January, with a capacity of 40,000 bbl per day, to release 3½ tankers. Another project includes a 60,000 bbl pipeline from Baton Rouge to Greensboro, N. C. with a possible extension to Norfolk, permitting release of 10 tankers. The Department of Interior is reported as working on plans for a new crude pipeline from Wood River, Ill., to the New York-Philadelphia area.

Obviously the construction of these lines, while of great benefit for the heating season of 1942-43 would be of no use during the coming winter.



Union Calendar No. 232

77TH CONGRESS 1ST SESSION

H. R. 4816

[Report No. 685]

IN THE HOUSE OF REPRESENTATIVES

MAY 20, 1941

Mr. COLE of Maryland introduced the following bill; which was referred to the Committee on Interstate and Foreign Commerce

MAY 29, 1941

Reported with amendments, committed to the Committee of the Whole House on the state of the Union, and ordered to be printed

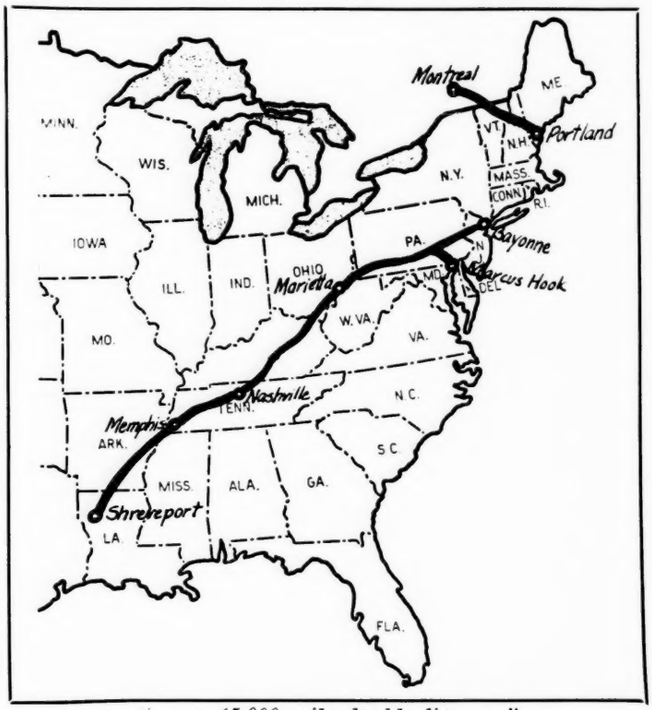
[Omit the part struck through and insert the part printed in italic]

A BILL

To facilitate the construction, extension, or completion of interstate petroleum pipe lines related to national defense.

the Senate and House of Repres

"To facilitate the construction.... of pipe lines...."
The Cole bill has passed the House, awaits action by the Senate. It would authorize $160,000,000 in new lines.



"....a 15,000 mile double line...."
This proposed $70 million, 24 in. crude oil line will be built if the Cole bill passes. Construction has been started before the bill's fate is known.

Tank Cars

The reason why the bulk of the oil from the Gulf to the Eastern Seaboard is carried by tankers is due to the low rates. However, the changed conditions may necessitate a reversal in the means of carrying the oil. On June 19 Ralph Budd, transportation commissioner of the Advisory Commission to the Council on National Defense, stated that there are in this country 150,000 tank cars of which 130,000 are owned by oil companies or by private car companies and leased to oil companies. Mr. Budd asked the owners and lessees of these car companies to ask for a cooperative agency to supervise the movements of these cars for the purpose of securing quicker routing. On June 29 New York's *Daily News* published a photograph showing a number of railroad tank cars with a caption that " . . . somebody discovered there are some 19,000 tank cars lying idle around the country." This was hardly a fair statement, for both the railroads and ICC have weekly reports on idle cars; in fact two weeks previously, J. G. Luhrsen, executive secretary of the Railway Labor Executives Association, reported that the railroads had 19,000 tank cars now lying idle and urged their use in correcting the trouble. He further declared that the War Department's commodities division definitely disagreed with the idea that pipelines are needed.

On June 25 Mr. Ickes put further pressure on this phase of the transportation problem by asking the oil industry to utilize fully the railroad tank car capacity in spite of the expense as compared with the use of tankers. His request was telegraphed to the various companies operating on the eastern coast.

Other Transportation

A fair quantity of oil might be carried by *trucks* belonging to fuel oil and gasoline distributors who, late in June, were at least considering and discussing the possibility of pooling their trucking facilities so as to release trucks to make the long haul to near western sources.

Barge transportation is also being studied, particularly with a view to the possibility of shipping from Gulf ports to the west coast of Florida for transfer to motor truck and railroad tank cars.

Position of Oil Burner Industry

The threatened fuel oil shortage obviously placed the oil burner manufacturers and dealers in an embarrassing position. Within two weeks after the transfer of the 50 tankers to British service full advantage of the problem confronting the oil burner industry was being taken by salesmen for competing fuels. This was further aggravated by a suggestion of a committee of the American Petroleum Institute June 3 that oil heated homes be kept at 5F lower temperatures this winter, and by a June 5 statement of Coordinator Ickes advising eastern residents building new homes not to install oil burners which could not be converted to use coal.

Before this, however, late in May, action had been taken by Oil Burner Institute in this matter and Secretary C. F. Curtin and R. M. Sherman, chairman of the OBI Emergency Committee for National Defense, conferred with Leon Henderson's Office of Price Administration and Civilian Supply.

Following this oil burner men and directors of American Petroleum Institute met in a special session which resulted in the appointment of a fact-finding committee in order to present to the office of production management a report to guide that office in its investigations. A comprehensive and voluminous report was issued by the oil burner industry, emphasizing that the oil burner industry was an essential one; that the proper heating of oil burning homes was of more consequence than joy-riding; and that heating oils are an important balance wheel for the oil industry, itself. However, in order to assist the government in its dilemma in solving the problem OBI made a valuable suggestion, which may prove to have far-reaching consequences.

This suggestion was ably summarized on June 2 by Ray G. Whipple, president of OBI, in which he outlined OBI's program as advocating:

"1. A war on waste. This is a country of plenty, and our bounties in oil and other materials and products, with intelligent use and conservation, can prevent arbitrary rationing and restriction.

"2. Bring up the efficiencies of existing oil burner equipment by raising the minimum operating requirements to, or above, Commercial Standard CS 75-39. An estimated saving in fuel from 25 to 30% is possible.

"3. Require minimum Commercial Standards in all the new installations and request government agencies to cooperate by insisting on the same compliance to standards in their purchases.

"4. Better house insulation practice, weather stripping, etc., in the interest of conservation of heating fuels.

"5. A cooperative program with other agencies using petroleum products to conserve oil by eliminating waste. Inefficient use of motor cars and trucks affords a big field for fuel savings.

"6. Conservation of use by greater efficiencies in all fields, as a practical defense measure.

"This program is reassuring and constructive. It offers broad and vital possibilities for practical and patriotic service on the part of government, industry, and consumer, thereby answering the President's emergency call.

"I call on all members of the Industry—direct or indirect—to exert to the fullest measure, their influence to "War on Waste" in every form and to work wholeheartedly for complete realization of the Oil Burner Industry's resolution. . . ."

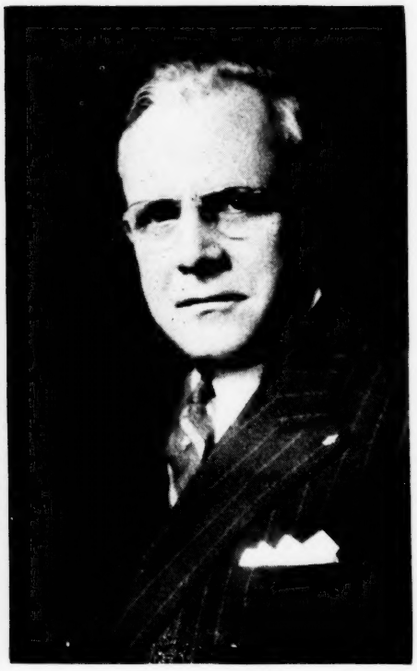
Individual burner companies lost no time in supporting OBI. By the middle of June Delco Appliance Division of General Motors Sales Corporation had already scheduled an advertising campaign offering a 24-page book with practical suggestions for conserving fuel in home heating, and outlining 82 ways to conserve fuel (of all kinds) in house systems. This up-to-the-minute campaign was handled by Stewart, Hanford and Casler, Inc., Rochester advertising agency.

By the last week in June a New York advertising agency was hard at work preparing an enormous campaign to sell consumers on the idea of having their oil

"Oil must and will be supplied for present domestic heating installations...." according to the Office of Petroleum Coordinator Harold L. Ickes.

There is no shortage of crude oil
There is no shortage of refining capacity
There is no shortage of gasoline
BUT-
There is a shortage of transportation

An Esso Marketers poster from a Standard Oil house organ which features Esso's tanker and pipe building programs to relieve the shortage.



"Bring up the efficiency of existing oil burner equipment...." is part of the OBI program announced by president Ray G. Whipple.

burning plants inspected and modernized so as more efficiently to burn oil and consequently conserve fuel for the democracies.

Position of Competing Fuels

In advertising circles it was reported that Anthracite Industries Inc., and the National Coal Association were both considering new advertising campaigns further to promote their respective fuels. While gas company salesmen were said to be using this subject locally nothing had been done nationally along these lines by the end of June.

Iron Fireman Mfg. Co. reported June 26 that summer stoker orders were 70% ahead of last year. This company held dealer meetings in June to assist dealers in opening their fall campaign two months ahead of time.

At the National District Heating Association convention in Pittsburgh early in June attention was called to the oil shortage and its effect on the sale of district steam. President Phillips of that Association pointed out that this might be the long-looked-for opportunity for district heating, adding that his company, New York Steam Corporation, is already serving Standard Oil's famous 26 Broadway, whose oil burners were taken out of commission late this spring

Position of Consumer

The threatened oil shortage from the standpoint of the consumer was the subject of a radio address June 20 by Representative Thomas H. Eliot of Massachusetts over certain NBC stations in which he said: "In the first place there is not an oil shortage. There is plenty of oil in America. The shortage is threatened because fifty tankers which normally transport oil to the Northeastern ports of this country have been taken off the Atlantic seaboard presumably in order to help England. It is a transportation shortage.

"That is supposed to leave the Eastern seaboard and particularly New England with an oil supply next year about 20% below present requirements.

"But there are a number of very serious questions which we in New England want answered. First, what about a rumor that there is really no shortage of oil in the East at all but that millions of gallons are now stored in the East as a supposed reserve. Reserve for what? Second, is all oil now in the East being kept in the East or is some of it being shipped West or to foreign countries? We are all glad to hear that Secretary Ickes has stopped the shipment of oil from Philadelphia to Japan. We want all shipments away from the East stopped.

"Third, we want to know more about these fifty tankers which will no longer supply the Eastern coast with oil. If they are carrying oil and gasoline to Great Britain, to fill the fighting requirements of Great Britain, that is one thing. Is that how they are being used? We have not got enough facts on this situation. The people of New England want to know the facts on this situation. The people of New England want to know the facts and I think they are entitled to know them. They are entitled to know if it is true that these fifty tankers have merely released some British tankers from the Atlantic, so that the British tankers can transport oil from the East Indies to Japan. The charge has been made that after we gave these tankers to Great Britain, British tankers began carrying oil from the Dutch East Indies up to Japan, at a profit for the oil companies which were selling the oil to Japan."

Position of the Government

Commenting upon the action of OBI in starting its conservation campaign, Coordinator Ickes said:

"The serious effort by any American industry or industrial group to meet the impending petroleum transportation situation in the Atlantic States is welcome news. Strenuous cooperative efforts, such as that of the Oil Burner Institute, which promises to save significant amounts of petroleum products, will go a long way toward helping to solve our petroleum difficulties.

"We face a set of hard facts regarding petroleum that will require all of us to make some kind of adjustments. I am sure that American industry, as well as individual citizens, can help to meet the situation. Conservation of petroleum products is certainly one way, and I hope that this movement will be widely expanded."

Position of Automobile Industry

Fuel oil and gasoline are inextricably tied together in the current problem. Conservation of gasoline as well as fuel will be necessary. The part of the motorist in the conservation program, as suggested by Thomas P. Henry, president of the American Automobile Association, would consist of the following steps:

First, a campaign to obtain motorists' cooperation in cutting down speeds and adopting other fuel-saving practices;

Second, if this fails to make enough saving, an effort to obtain voluntary action from motorists in refraining from non-essential driving;

Third, restriction by regulation only if these measures fail and the shortage reaches emergency proportions.

The American Automobile Association says that motorists of this country can save 20% of their fuel if they would drive at more reasonable average speeds; if they would not try to jump the gun at the stop light, and if they would have their engines adjusted properly. A 20% saving in gasoline in 1941 on the East Coast would mean a saving of about 44,000,000 barrels.

Late Report from Washington

"Oil must and will be supplied to operate defense manufacturing facilities.

"Oil must and will be supplied for present domestic heating installations and those under construction; new domestic installations are not encouraged at this time along the Atlantic Seaboard Plateau or the Coastal Pacific Northwest.

"Threatened shortages of oil in these areas are strictly temporary; are due entirely to disrupted transportation facilities; six months of conservation starting now may be sufficient to effect complete readjustment!"

The foregoing, in brief, is the "last word" (as of June 30) on the petroleum emergency situation, as explained to HEATING AND VENTILATING at the office of Coordinator Ickes.

Maximum production is the first line of defense and the comfort of defense workers, both indirect and direct, has a direct bearing upon factory output. Therefore the accomplishment of these two objectives will be the yardstick by which the office of the Petroleum Coordinator will judge proposals to conserve present stocks and to readjust transportation facilities necessary to bring about a return to normalcy, it was explained.

Conclusion

About the only clear-cut impression one gets from all the foregoing statements is that the situation is indeed confused. However, a fair summary would run somewhat as follows:

(1) The oil companies are not sticking their necks out, are apparently issuing no definite statements. Obviously they feel that they are not responsible for the shortage and are not going to get involved in an embarrassing situation;

(2) The oil burner industry insists that there will be no shortage, but that if there is it should be a gasoline, and not a fuel oil shortage, and is doing a highly commendable job in promoting oil conservation;

(3) Coordinator Ickes, judging from his or his associates' statements, apparently does fear a shortage.

Our own conclusion, after a careful study of available information—and there is none too much available—is that there will *probably* be no serious shortage *provided that* (a) no more tankers are transferred either to British service or (b) for servicing our own outposts if we should get involved in Greenland, Azores, or Dakar or similar points.

Constant Low Temperature Rooms for Biological Laboratories

The new Alfred I. duPont Institute of the Nemours Foundation, on the outskirts of Wilmington, Del., which performs a service to humanity in caring for children, either crippled or disabled by chronic diseases, and in carrying on research work in the treatment and prevention of these diseases, is equipped with a thoroughly equipped bio-chemical laboratory, with constant temperature rooms. Past experiences have shown that the most desirable temperatures for this type of work are 2C and 20C. The two rooms are independently operated at these temperatures with adequate working space and storage room for solutions in the process of precipitation. These "cold rooms" were engineered by W. A. Kochenberger of the York Ice Machinery Corporation Philadelphia office and installed by Houser Refrigeration, York distributor in Wilmington.

This is no ordinary cooling installation, for temperatures must be maintained at exactly 2 and 20C, hour after hour, day after day, month after month. Solutions are placed in the rooms and may be left there for weeks or months before complete precipitation of the desired elements takes place. Many different experiments may be going on in these rooms at the same time. A shut-down in the refrigerating machinery might mean a loss of as much as a year of experimentation and observation.

Two York "Freon-12" refrigerating units supply refrigeration. Two fan-fin space chillers cool and uniformly circulate the air in the rooms. Two roller-seal doors provide adequate protection against heat leakage.

Efficacy of Window Shades as Heat Barriers Investigated by Armour Foundation

A STUDY of the effect of window shades in excluding heat from the sun during the summer time and in retaining indoor heat during the winter time has been completed at Armour Research Foundation, and the results reported by Window Shade Institute.

Based on these tests it is reported that a single cloth shade, fully drawn over each window of a room during the hours that it is exposed to the summer sun, will reduce heat intake by an average of about 45%, but that a *pair* of cloth shades of the same type drawn over each window will reduce the heat intake by about 65%. On the other hand, under winter conditions, a single shade fully drawn reduced the heat loss through the windows by an average of about 40%, whereas a pair of cloth shades of the same type diminished the heat loss by approximately 54%.

Keeping heat in, under winter conditions, appears to be affected by the thermal resistance (i.e., resistance to the transmission of heat) of the cloth itself rather than by its color. Also, because of the air space between the shade and window, good fit of the shades is important in preventing loss of heat.

In making the tests, the experimenters employed a heavily insulated test house, 10 x 10 x 8 ft, with a single window consisting of two sliding sashes, each glazed with one pane of 24 x 24 in. single-strength glass. The test house was built inside a room which was kept at constant temperature and was itself kept at the same temperature during the experiments by either a heating or a cooling system. Means were provided for measuring the amount of heat that had to be abstracted or added to keep the temperature of the interior of the test house constant, thereby also measuring the amount of heat entering the house through the window under summer conditions or leaving it through the window under winter conditions.

Summer Tests. To approximate the amount of heat provided by the sun in summer, 72 lamps were mounted in a box-like structure just outside the window. A current of cool air was arranged to flow between the lamps and the window, which permitted the radiant heat from the lamps to pass through the window but removed the sensible heat and protected the glass from breaking. With this arrangement, the heat intake through the unshaded window was 320 Btu per square foot of glass surface. Measurements were then made of the heat intake of the test house when the window was protected in various ways by cloth shades. A single shade, fully drawn, reduced the heat intake about three times as much as a half drawn shade; and two shades fully drawn reduced the heat intake considerably more.

Table 1 shows the results obtained.

For shades of a given quality and texture, the reduction of the heat intake varies with their color, being greater with light shades, especially white, than with dark shades. This is due to the higher reflectivity of the light colors.

TABLE 1. TEST OF WINDOW SHADES, SUMMER CONDITIONS

Type Shade	Location	Position	Reduction in Heat Intake, Percent: Dark Green	White	Buff
Hand	Inside casement	Fully drawn	34.04	49.29	47.34
Hand	Outside casement	Fully drawn	26.39	42.31	36.37
Hand	Inside casement	Half drawn	10.44	13.00	12.40
Hand	Outside casement	Half drawn	10.53	13.87	11.14
Hand	Pair installation	Fully drawn	61.37	67.53	62.86
Water color	Outside casement	Fully drawn	39.13	57.50	53.21
Holland	Outside casement	Fully drawn	41.51	52.34	54.75*
Holland	Outside casement	Half drawn from top	17.42		
Holland	Outside casement	Half drawn from bottom	24.24		

*Flax color.

From these data the heating effect of the summer sun on a south-facing, normally-furnished living room 18 x 20 x 10 ft, with a window area of 70 sq ft, was calculated.

It was found that the heat absorbing capacity of the room and its contents would be 2980 Btu per F, and that the amount of heat entering the unshaded windows would be 22,400 Btu per hour.

Winter Tests. To simulate winter conditions, a refrigerating coil was placed outside the window of the test house. This maintained a temperature of 10F at the window panes, while a temperature of 80F was maintained inside the test house by means of an electric heater.

The energy consumed by the heater showed that the loss of heat from the room through the unshaded window was 1.44 Btu per hour per sq ft of glass per F temperature difference between the inside and outside, or 806.4 Btu per hour for the window under the conditions of the experiment.

Two cloth shades fully drawn reduced the heat loss by about 54%, as against an average of about 40% for a single shade of the same type. The results obtained are shown in Table 2 below.

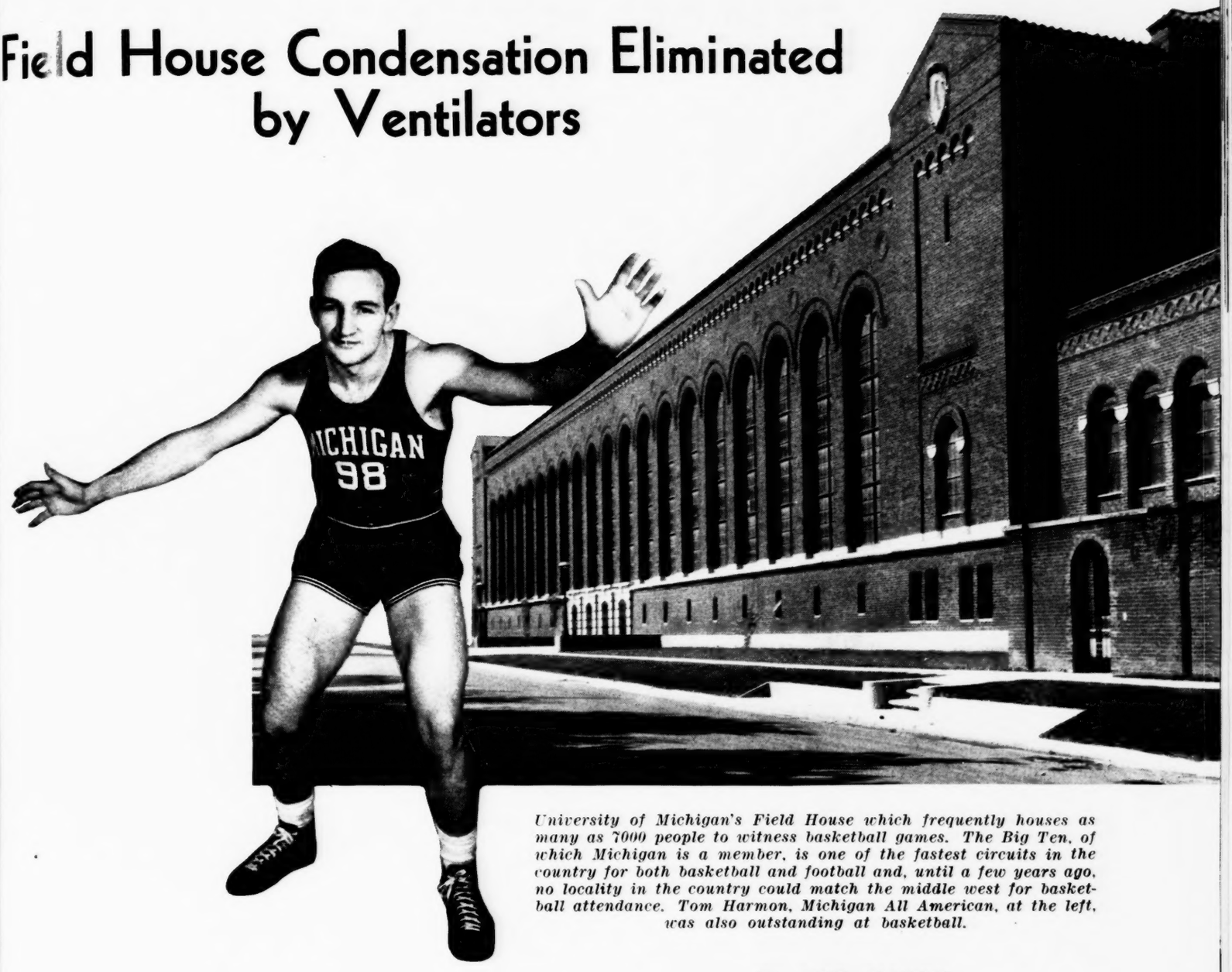
Under these conditions, window-shade color has a negligible effect, but the thermal resistance of the cloth and of the air spaces between the shade and frame are important. To secure maximum results, the shades must fit the frame well.

TABLE 2. TEST OF WINDOW SHADES, WINTER CONDITIONS

Type Shade	Location	Position	Reduction in Heat Loss, Percent: Dark Green	White	Buff
Hand	Inside casement	Fully drawn	39.59	38.00	40.55
Hand	Outside casement	Fully drawn	41.79	42.90	42.34
Hand	Inside casement	Half drawn	37.21	36.18	33.66
Hand	Outside casement	Half drawn	31.62	29.02	30.12
Hand	Pair installation	Fully drawn	54.14	52.83	53.86
Water color	Outside casement	Fully drawn	48.62	49.23	47.86
Holland	Outside casement	Fully drawn	49.45	48.90	46.90*

*Flax color.

Field House Condensation Eliminated by Ventilators



University of Michigan's Field House which frequently houses as many as 7000 people to witness basketball games. The Big Ten, of which Michigan is a member, is one of the fastest circuits in the country for both basketball and football and, until a few years ago, no locality in the country could match the middle west for basketball attendance. Tom Harmon, Michigan All American, at the left, was also outstanding at basketball.

By AXEL MARIN†

How a fog problem in the University of Michigan's Field House, which has a volume of 3 million cu ft, can be solved by the use of roof ventilators is described here by Professor Marin who recommended changes described. The article shows the calculations for natural draft, based on the neutral zone theory, which were made to determine the area of roof ventilators required.

THE ventilation of large auditoriums, particularly those in which considerable crowds gather, offer many problems to heating and ventilating engineers. One of the problems which the engineer is apt to encounter is illustrated in a trouble found recently in the Field House of the University of Michigan at Ann Arbor, Michigan. This building is used for sporting events such as basketball and indoor track meets and it frequently holds crowds of as many as 7000 people.

During periods of large attendance when the outside temperature was low, the moisture given off by the spectators and players presented an annoying condition. The vapor given off by the people would increase the humidity of the air and this humid air would rise and be trapped in the upper level under the roof. A considerable portion of the vapor, upon coming in contact with the under side of the roof which was below the dew point temperature, would condense and drip on the playing floor. These wet spots caused many a serious fall and frequently between periods of a basketball game it was necessary to mop the floor in order to provide safe playing conditions.

The University of Michigan Field House is a building approximately 313 ft long by 153 ft wide and 80 ft high, has a volume of 3,000,000 cu ft and is heated by fan system of heating. Three Utica Imperial Supersmokeless boilers, each with 15 sections and each rated at 10,250 sq ft of steam surface are used for heating.

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The boilers supply steam to two Vento heaters which heat the air supplied by two American Blower Sirocco fans. Each of these has a capacity of 40,000 cfm. A heat loss survey of the building showed that when the building was unoccupied in zero weather and with a 60F inside temperature the heat loss was approximately 4,300,000 Btu per hr.

In operation the heating system recirculated practically all of the air and only small amounts of outside air were brought in. When 7000 people were in the Field House about 1500 lb of water vapor per hour was added to the air and since little outside air was brought in the moisture content of the interior air gradually increased.

One suggestion made was that if large amounts of outside air were introduced the moisture content of air could be kept low enough to prevent the condensation. One method of doing this was to open the windows during the games to supply outside air and to install roof ventilators to carry off the moist air. This suggestion was ruled out because of the drafts which would result from the open windows. It was decided, rather, to use the warm air heating system to supply heated air and to install roof ventilators to carry off the exhaust air. It was felt that this would give an installation which would supply plentiful quantities of outside air without danger of drafts.

It was decided to supply a minimum of 8 cfm per person during periods of peak occupancy. This meant that during these periods it was necessary to supply 8 cfm x 7000 people x 60 min per hr or 3,360,000 cu ft per hr of ventilation air. Since the heating system could supply 80,000 cfm or 4,800,000 cu ft per hr, the capacity of the fans was adequate.

In operating the system it was decided to have the fans supply the required amount of air at sufficient pressure to just force the air into the room and to depend upon the natural gravity action to exhaust the air through the roof ventilators. Thus, the problem was to determine the amount of roof ventilator area to provide to allow 3,360,000 cfm to escape per hour.

The pressure which causes the air to flow through the roof ventilators is due to the difference in density between the heated air inside and the cold air outside. This pressure is equal to the difference in weights of the two columns and the formula for the pressure head in terms of feet or air is

$$h = \frac{Z \times D}{T}$$

where

Z is the distance from the roof to the neutral zone,

D is the difference in the temperature F, and

T is the average of the absolute temperatures F.

The neutral zone mentioned is an imaginary horizontal zone in the building at which the air pressure inside is just equal to the atmospheric pressure outside. In any heated building the air inside is lighter than the air outside and therefore tends to rise. Thus, there is exerted a slight pressure on the roof and upper walls of the building and a slight vacuum on the floor and lower walls.

It can be seen, therefore, that somewhere between these there is a neutral zone in which the inside pressure is just equal to the atmospheric pressure. This is the neutral zone referred to in the formula.

The location of this zone in any particular building depends on the relative resistance of the inlet and outlet openings. Where the inlet openings are small in comparison to the outlet openings the neutral zone will be somewhat above the center of the building. On the other hand, where the inlet openings are considerably larger than the outlet openings the neutral zone will be below the center of the building.

Since most buildings are equipped with adjustable openings the location of the zone will vary. In these cases the zone is taken half-way between the floor and the ceiling for design purposes.

The pressure head which could be expected in the Michigan Field House was calculated as follows:

The distance from the neutral zone to the roof was one-half of 80 ft or 40 ft. The temperature difference for 60F inside air and 20F outside air was 40F. The average for the absolute temperatures was

$$\frac{520 + 480}{2} = 500 \text{ F}$$

Therefore, the pressure head available to cause a flow through the roof ventilators is

$$h = \frac{40 \times 40}{500} = 3.2 \text{ ft of air.}$$

The flow through an opening can be expressed by the formula

$$Q = \sqrt{\frac{h}{R}}$$

Where Q is the flow in cfs, h is the head in ft of air and R is the resistance of the opening.

R is expressed numerically as the head in ft of air necessary to force 1 cfs of air through the opening. R can be determined from the following formula:

$$R = \frac{1}{2g\ A^2\ C^2}$$

Where g is 32.2, A is the clear area of the opening in square feet, C is the coefficient of the opening. This can be taken as 0.65. Therefore the resistance of 1 sq ft opening is

$$R = \frac{1}{2 \times 32.2 \times 1^2 \times 0.65^2} = .000367$$

The amount of air which will flow through a 1 ft opening is therefore

$$Q = \sqrt{\frac{h}{R}} = \frac{3.2}{.000367} = 9.36 \text{ cfs}$$

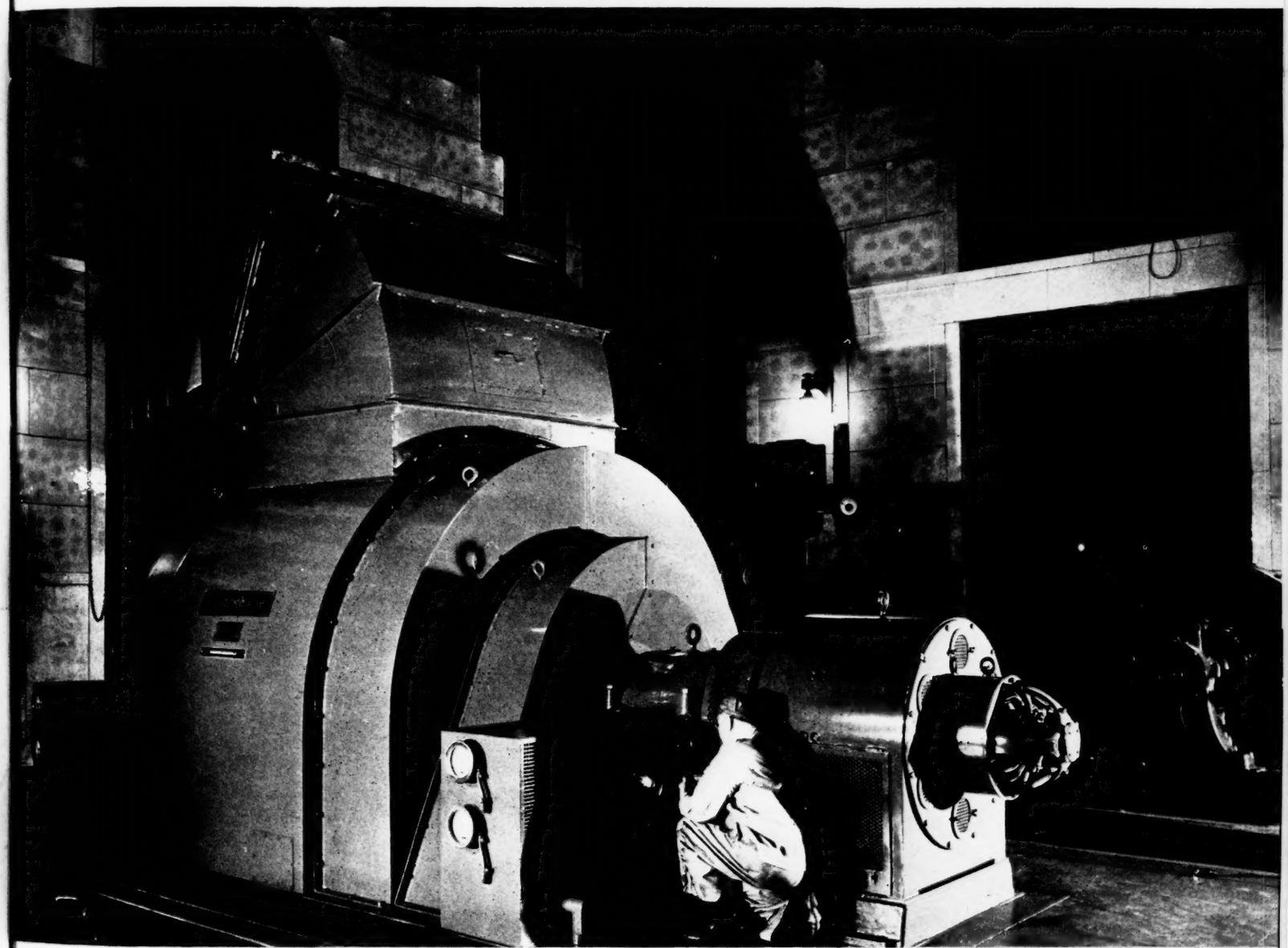
Since 3,336,000 cu ft of air has to pass through the opening in an hour the area of the opening must be

$$\frac{3{,}336{,}000 \text{ cu ft per hr}}{9.36 \text{ cfs} \times 33{,}600 \text{ second per hr}} = \text{approx. } 100 \text{ sq ft}$$

This is the area of the roof ventilator opening selected and to be installed in this building.

The installation is to be made during 1941 and it is certain that in the winter of 1941-42 the air conditions in the building will be much improved and that the condensation will be completely eliminated.

PROFITS IN AIR



This synchronous condenser at the Gorge Steam Plant of Ohio Edison Company, Akron, is ventilated by 40,000 cfm of air cleaned by 56 Westinghouse Precipitron cells. These will remove 50 to 75 bushels of dirt per year, eliminating periodic dismantling and cleaning.

A SECTION OF "HEATING & VENTILATING" SHOWING HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF ATMOSPHERIC CONDITIONS

PROFITS IN AIR

ELECTROSTATIC AIR FILTERS

help industrial plants eliminate losses resulting from contamination of products by dust, smoke and fumes.

By H. W. POUND†

INCREASED industrial activity has brought about greatly increased atmospheric contamination in our manufacturing areas. This contamination is composed largely of smoke and other air-borne impurities so small that they respond only to the Brownian movement. Such minute materials might be considered permanent atmospheric impurities since they tend to remain suspended indefinitely in the air.

With the advent of blacked-out, windowless buildings where air conditioning is a prime requisite, many industries are searching for equipment which will give them the degree of air cleanliness necessary for ventilation and to maintain the high standards of their manufactured products. Since the losses resulting from contamination by atmospheric dust, smoke and fumes are usually greater than from any other cause, air cleaning equipment is receiving more careful consideration today than ever before.

†Manager, Electro-Matic Sales, American Air Filter Co., Inc.

Textile Plants

The textile field is a typical example of an industry where dust and smoke have become a major problem, particularly in spinning rooms, where these atmospheric impurities tend to stain or discolor white yarn. With forced ventilation necessary for air conditioning and humidity control, this problem has become increasingly severe. Heretofore there has been no practical way to eliminate this soilage, but with the advent of electrostatic air cleaning many firms have definitely solved this problem and are able to maintain definite cleanliness standards. Louisville Textiles, Inc., Louisville, Ky., for instance, have reported that on one occasion through the accidental shutting off for a period of four

One of the two spinning rooms in the plant of Louisville Textiles, Inc. Electro-Matic air filters remove the dust and smoke which tends to stain or discolor white yarn.

HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF ATMOSPHERIC CONDITIONS

hours of the electrostatic filter serving their spinning rooms, an entire run of yarn was spoiled. Other manufacturers in this field who report outstanding success with electrostatic air cleaning are the Cross Cotton Mills, Marion, N. C., Davenport Hosiery Mills, Chattanooga, Tenn., and Johnston Mfg. Co., Charlotte, N. C.

Photographic Film

The manufacture of photographic film is another industry requiring ultra clean air. "It is bad enough for a dust spot to mar the prima donna's face," said a film executive, "but for a speck of dust to get on the sound track and cause her to gargle in the middle of a high C is unpardonable." Film manufacturers in the past have used a combination of several types of air cleaners to obtain the high degree of air cleanliness they needed. First there was an air washer followed by a viscous filter, two stages of dry filters and then another viscous filter. Even this combination was inadequate during winter months when residential heating systems were operating at peak capacity. Film manufacturers who are now using electrostatic filters state that their dust and smoke problem has been entirely eliminated. There is also a considerable saving in valuable floor space with the installation of electrostatic filters, which will ultimately offset their higher first cost.

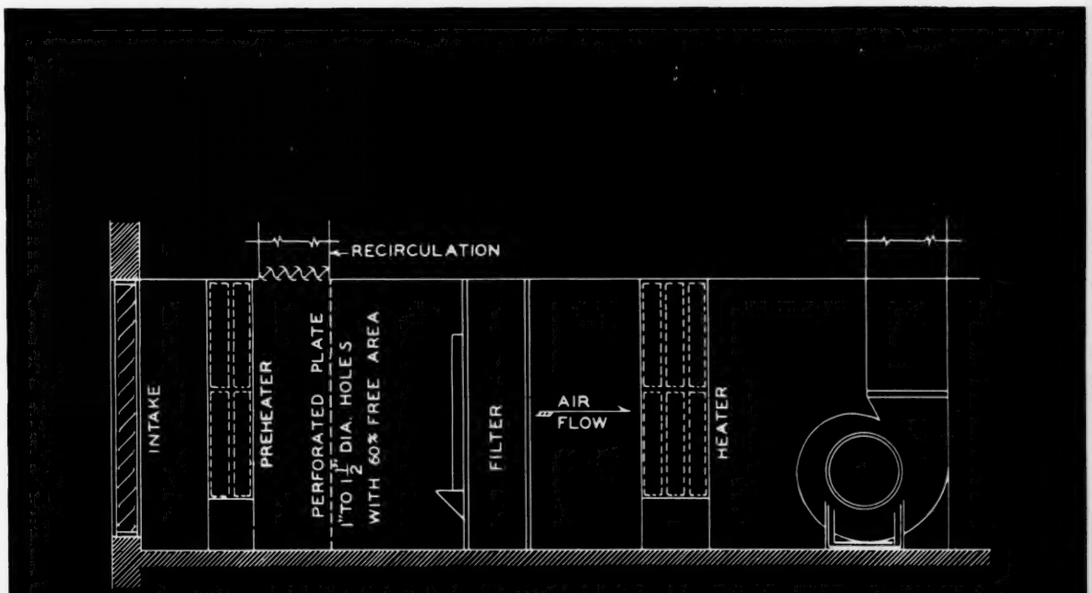
Food

The food industry has many manufacturing operations in which products are subject to deterioration from bacteria, mold spores and smoke. One manufacturer whose product is affected by wild yeast spores ran a series of tests with electrostatic filters to determine the efficiency of this type of equipment in the removal of these minute air-borne particles. Twelve different tests were made with two different filters, one in a laboratory set-up and the other in an office air conditioning system, and regardless of the number of spores in the unfiltered air, they were unable to find a single spore in the electrically cleaned air. From this test it appears that the electrostatic filter is 100% efficient in the removal of wild yeast or similar spores.

Welding

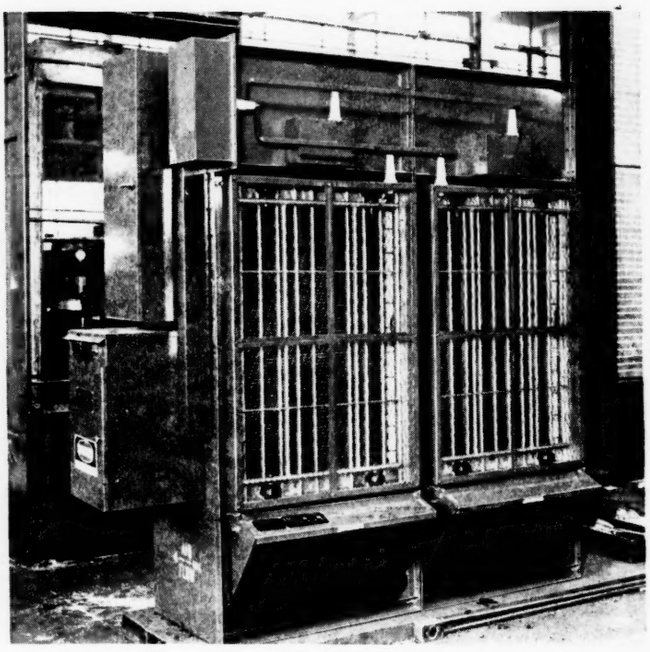
In aircraft manufacture, particularly in the new windowless buildings, it has been found that electrostatic filters are able to remove oil vapors and welding fumes from the recirculation air and thus maintain more nearly ideal working conditions. A recent installation of 1,573,000 c.f.m. of Electro-Matic filters has been made in the Ford Aircraft Bldg., Dearborn, Mich.

Increased use of welding with the necessary flux has created a hygienic problem in many industries. One method used to take care of this problem has been to introduce sufficient fresh heated air, to reduce the concentration of fumes. The use of electrostatic filters which remove a high percentage of these fumes makes possible the recirculation of the air with a tremendous saving in first cost as well as operating costs. Such in-



Cross section of an intake air heating system showing how electrostatic filter is installed. Note use of perforated plate which is designed to insure uniform air flow over the entire face area of the filter.

Three of the six electrostatic filters at the Hammond, Indiana, sewage disposal plant which provide ultra clear air to protect the ceramic plates used for aerating the sludge.



View of typical electrostatic air filter during installation. Plenum chamber has not been erected around filter. These filters are effective in removing fine dusts and smoke.

stallations are now in service at the General Electric Co., Erie, Pa., and Budd Wheel Co., Detroit, Mich.

Oil vapors and oil mists have heretofore constituted an unsolved problem when present in air used to cool generators or large motors. The use of electrostatic filters has solved this problem for Tidewater Associated Oil Company, Bayonne, N. J., and American Rolling Mills, Middletown, Ohio.

Department stores using these filters report considerable saving in loss of merchandise and redecoration costs. Electrostatic filters reduce the dirt accumulation on grilles and outlets from the ventilation system.

On one installation of these filters in an industrial plant the owners have reported 50% less loss of time from sickness due to air-borne infectives among the workers than in previous years before the installation of the filters.

Dust Removal Efficiency

Mechanical air filters have proved adequate in the removal of atmospheric dust which normally settles out of air. Their effectiveness is limited, however, to particle sizes which have sufficient mass to be filtered out of the air. The smallest particle size visible to the naked eye with normal vision is approximately 10 microns. Well designed mechanical filters will remove more than 90% of 10 micron size particles from the air but their efficiency falls off rapidly as the particle size is reduced below this point.

Since electrical precipitation employs the principle of electrical attraction to remove solid impurities from the air stream it is effective with much smaller and lighter particles. By this method it is possible to remove not only fine dust particles, but oil vapors, welding fumes, and even tobacco smoke, which averages about 0.25 microns in size.

The precipitation of smoke and fine air-borne particles cannot be satisfactorily evaluated by the count or weight method of determining efficiency, but can be determined accurately by the U. S. Bureau of Standards Discoloration test method. This method of measuring efficiency can be used on atmospheric dust to test any air cleaning device under actual operating conditions. Efficiency is determined by drawing samples of filtered and unfiltered air through chemical filter paper, the volumes of air being adjusted until equal blackness is obtained. The relative discoloration of the two samples is compared by means of a photoelectric cell. If, for example, 1 volumetric unit of unfiltered air gives the same blackness as 10 volumetric units of filtered air, the efficiency is said to be 90%.

It is now possible to meet practically any requirement for clean air. The efficiency of an electrostatic filter in the removal of smoke and vapors can be increased by merely reducing the air velocity through the cleaner. At the normal velocity of 500 ft. per min., the efficiency by the U. S. Bureau of Standards Discoloration Method of Test is 85%, as compared with 20% for the best felt filter. This efficiency can be increased to 90% by reducing the velocity to 400 ft. per min. At 300 ft. per min. the efficiency is 95%, and continues to approach 100% as the velocity is further reduced. Thus, industry may now write its own specifications for the degree of air cleanliness required by its various processes.

Several types of electric precipitators are now commercially available. One of these is the Electro-Matic air filter, which incorporates electrical precipitation as an integral function of an automatic self-cleaning air filter to obtain the combined advantages of both methods of cleaning air and to eliminate the human element as a factor of maintenance and performance. It embodies the conventional vertical curtain consisting of

a series of angular shaped metal plates mounted in parallel on two endless chains which rotate over top and bottom of sprockets.

The self-cleaning action limits the amount of dust permitted to accumulate on the collector plates and makes possible continuous uninterrupted operation with minimum attention. This is accomplished by automatically rotating the filter curtain through a liquid bath which removes the collected dust and at the same time renews the viscous film on the cleaned plates. The viscous coating on the filter curtain is an important feature since it serves both as a medium in which the dust particles are trapped and as a dielectric which permits closer spacing of the plates with a proportionately stronger electrostatic field to further improve the efficiency. The importance of the viscous film on the collector plates is evidenced by the fact that when the dust particles touch a grounded plate it gives up its charge and is no longer attracted to the plate except by natural adhesion. Once trapped in the oil film, however, the dust particles cannot be blown off the collector plate and carried along in the air stream, even should there be a failure in the electric current.

The installation of electrostatic air filters is a simple operation almost identical with the installation of standard automatic filters. All internal wiring for electrical precipitation is made at the factory. Due to the low resistance of these filters it is sometimes advisable to install 50% free area perforated plates a distance from 3 to 4 ft. in front of the filters in order to maintain a uniform air flow through the filters. Since air velocity is a determining factor in the efficiency of an electrostatic air filter every precaution should be taken to insure uniform air flow over the entire face area of the filter curtain.

In installing the filters ample space should be provided for servicing and cleaning and all sheetmetal duct work should be tightly sealed to prevent leakage of unfiltered air. The filters should be located so that rain or snow cannot be carried into the curtain.

The frequency of cleaning of these filters depends upon the amount of dirt in the air and the daily hours of service. It is estimated that under maximum conditions about three cleanings a year are necessary. One authority has stated that their experience has shown that these filters in air conditioning service require about two man-hours of service per year per section.

No other air cleaner yet devised is comparable in efficiency to the electric precipitator. The initial cost is approximately twice as much as standard automatic impingement type filters. For this reason electric precipitation is not expected to replace all other types of filters but rather to extend high efficiency air cleaning to new fields which other types of filters cannot handle.

Precision Tool Room Conditioned

Precision grinding spindles, which are designed to turn at a rate of 50,000 revolutions a minute, are being manufactured at the plant of the Landis Tool Company, Waynesboro, Pa., with the help of air conditioning.

The Landis Tool Company specializes in manufacturing high production grinding machines for turning out a wide variety of precision parts for the automotive, airplane, ball-bearing, electrical, farm machinery, and steel industries and for metal working plants in general. The spindles assembled in this air conditioned laboratory carry the grinding wheel on a specialized type of machine used by the ball-bearing industry.

Because of the high speed at which these spindles operate they must be absolutely true, perfectly balanced, and free from vibration. Since the expansion and contraction caused by atmospheric variations may cause trouble in assembling these spindles it is necessary that the spindle laboratory be air conditioned.

Therefore, two Carrier air conditioning units were installed to maintain a year-round uniform temperature of 75F. Thermostatic control is provided to maintain the temperature within 1F.

The room is carefully insulated with double walls, windows and doors keeping it sealed tight from the outside influences. Only filtered, conditioned air is admitted through the two air conditioning units which supply 600 cfm to the room. The air conditioning units are connected to the blower heating system which heats the main floor so that the units can supply air at the proper temperature during the winter.

The air conditioning contractor was The Lamp Shoppe, Hagerstown, Md.

Spindle assembly laboratory which is air conditioned to prevent assembly troubles due to expansion and contraction of parts.

Heating costs in this plant indicate an excellent return on the investment made in modernizing the heating plant.

MASTER LOCK COMPANY

modernizes its Milwaukee plant, installs stoker-fired steam plant with unit heaters. Exceptional attention was paid to the layout and insulation of piping.

By JOSEPH H. VOLK

WHEN the Master Lock Company of Milwaukee, Wis., moved into its new premises considerable re-modeling was carried out in order to provide a strictly modern plant. This included a new heating installation consisting of a stoker-fired boiler, thermostatically-controlled unit heaters and other up-to-date equipment. Results during the past winter show that the investment is giving excellent returns, both as regards fuel consumption and well distributed heating, making for good working conditions.

The building was formerly heated by exhaust steam from a high pressure plant and pipe coil radiation. As the company does not require a high pressure boiler plant, and as the heating was decidedly old-fashioned, it was decided to remove all old heating work and install a modern low pressure plant in order to secure efficient and economical operation. Such items of old equipment as could be fitted in with the new system were salvaged and used insofar as was practicable.

A new Kewanee Type C boiler with a welded firebox was installed. This is rated to operate at 15 lb. pressure and to supply 42,500 sq. ft. of direct steam radiation. It is fired by means of a Detroit heavy duty single retort stoker rated for burning 1200 lb. of coal per hr., and is provided with a steel hopper of 600 lb. capacity. The forced draft fan is driven by a 7½ hp. Louis Allis motor. The ash pit is equipped with brass ash quench piping fitted with Jenkins valves. The automatic stoker controls are mounted on a steel panel and consist of a Cutler-Hammer automatic starter and safety switch for the stoker motor and a Mercoid automatic pressure control connected to the main steam header which can be adjusted for a range of pressure from 0 to 15 lb. There is also a low water cut-off control on the boiler.

A Patterson-Kelley hot water storage heater has also been installed in the boiler room. It is 48 in. in diameter and 10 ft. long, with a capacity of 940 gal. The water is heated by steam during the heating months and by a separate Kewanee coal-burning heater during the warm season. The latter has a capacity for heating 1000 gal. of water through a 100F temperature rise per hour.

A Skidmore automatic vacuum return line pump and receiver of a capacity for handling 30,000 sq. ft. of direct radiation against a 20 lb. head is another item of equipment in the boiler room. This pump is equipped for automatic vacuum and float switch control. It is driven by a 3 hp. direct-connected motor.

Careful attention has been given to the application

of adequate insulation to the boiler room equipment and elsewhere in the plant. Thus the boiler has been covered with 1½ in. thick 85% magnesia blocks and a ½ in. coat of asbestos cement finished with a heavy canvas jacket, and the hot water storage heater with 1 in. thick 85% magnesia blocks, ½ in. of asbestos cement and a canvas jacket. The steam mains, risers and branches, except branches to unit heaters, concealed piping, underfloor and underground returns have an asbestos air cell covering 1 in. thick. Fittings are covered with asbestos cement to the same thickness as the pipes to which they are connected and are jacketed with canvas. An outside steam main between the boiler room and another building has been insulated with a 2 in. layer of hairfelt over the other 2 in. covering, and is protected against the weather by a heavy cemented roofing jacket which is wired in place with copper wire. As there are some 22,000 ft. of piping in the plant for heating, in addition to the equipment in the boiler room, it is evident that adequate insulation is a very important item, not only in providing heat where it is wanted but also in avoiding waste and inefficiency in the heating system.

All pipe work has been done according to the two-pipe method with both mains and returns graded 1 in. in 20 ft. in the direction of flow, and pains have been taken to avoid depressions or pockets which would interfere with free drainage of condensate. Those horizontal branches in which condensation in an opposite direction is excessive have been graded 1 in. in 3 ft.

Piping of 4 in. diameter and more is suspended on malleable iron expansion pipe hangers of the roller type and smaller sizes on ring hangers. The suspension rods are fastened with lag screws to wooden construction and cinch expansion bolts where concrete construction is involved. The maximum spacing of hangers is 10 ft., and less where necessary to prevent sagging. Brackets are used where the piping is on the walls.

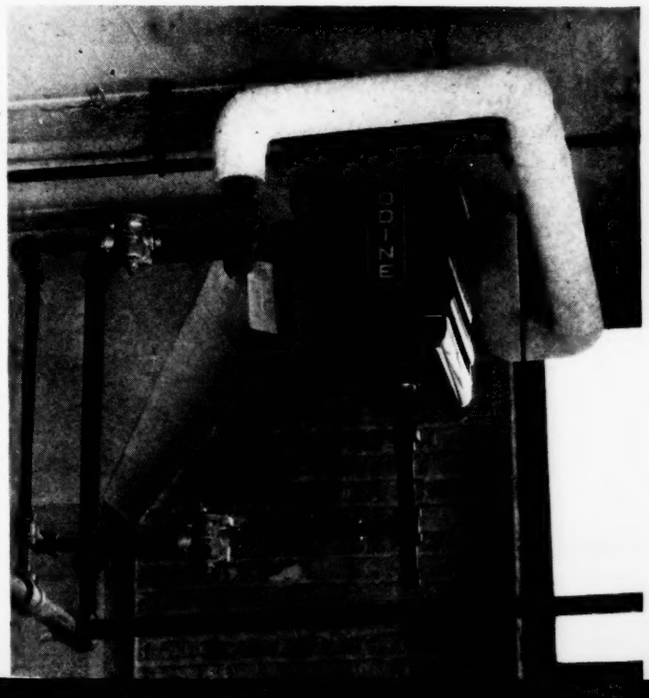
In cases where steam mains are reduced in size eccentric fittings have been installed to prevent any accumulation or lodgment of water. The ends of steam mains, drips and risers are dripped through traps to insure complete removal of all condensate on the supply side of the system. Another point about this carefully made piping installation is that where pipes pass through walls, partitions or floors they are protected with heavy galvanized iron sleeves 1 in. larger in diameter than the pipe. All underground and underfloor pipes are encased in sewer tile which has been cemented and made watertight. In addition, all piping has been installed with tight angle loops to allow for free expansion. All unions up to 2 in. in size have ground joints with bronze inserts, and those over that size are flanged and packed.

Valves on steam and return lines are standard gate valves, and on the unit heaters and radiators not automatically controlled they are standard nickel-plated radiator valves with ground union connections and composition wheel handles.

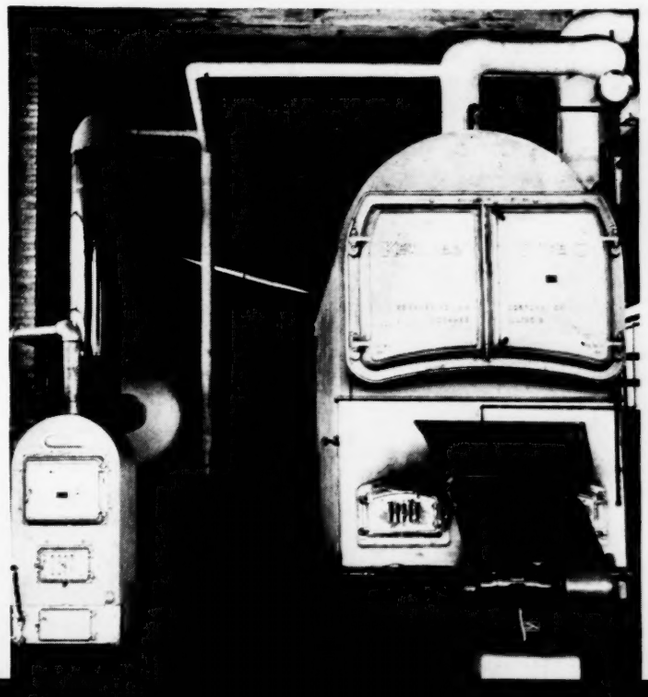
Traps have been installed on the unit heaters, hot water storage heater, ends of the steam mains, drips and riser drips. These are Armstrong traps of the float type with automatic air by-pass for vacuum service. Full sized dirt pockets have been constructed ahead of the inlet to all traps and standard swing check valves have been installed at the inlet to each. Radiators are equipped with Warren Webster bellows type nickel plated thermostatic radiator traps.

The manufacturing space is heated with Modine unit heaters, thermostatically controlled by Minne-

The unit heaters can be manually or automatically controlled through Minneapolis-Honeywell thermostats. Note the unions on both sides of the trap for easy removal.



The low pressure heating plant in the Master Lock plant is fired by Detroit stokers. The Patterson-Kelley storage tank has a capacity of 1000 gal. per hr.



apolis-Honeywell thermostats. The latter are provided with push button switches whereby the thermostats may be cut out of service and the unit heater motors manually controlled in case of necessity, each unit heater motor being provided with a two-speed switch. The steam connection of each unit heater is provided with a radiator valve and the return with a trap. Each trap is fitted with pipe unions of the same size so that it may be easily removed for repairs or replacement without loss of time. This arrangement makes it unnecessary to stock more than two or three spare traps.

An item in connection with the heating of the elevator shafts is the use of re-circulating ducts on the unit heaters installed in them. Provision for such re-circulation saves much heat otherwise wasted and also insures much better heating of the shafts.

In certain locations involving smaller areas such as toilet and wash rooms, store rooms and offices outside of the main office space where unit heaters were not felt to be suitable, use was made of radiators. Several from the old installation which were in good condition, or could easily be re-conditioned, were made use of in those locations. In other places new radiators were installed, and all are mounted either on the walls or ceilings rather than on the floor where they would take up valuable space and make dirt pockets.

The offices on the second floor are heated with Modine convector radiators of the cabinet type and recessed, and give a very good appearance to this space. They are provided with sheet metal cabinets, inlet and outlet grilles and dampers. Barber-Colman automatic temperature control has been installed here.

The installation was designed by the writer and installed by the Thos. E. Hoye Heating Co., Milwaukee.

Stokers Heat Toll Houses on 10-Lane Turnpike

One of the two main terminal gates of the ten-lane Pennsylvania Turnpike is heated by anthracite and the other by bituminous.

The extreme difficulty of heating the small glass-enclosed booths in which the ticketmen stay can be better appreciated when it is understood that the doors are constantly being opened and closed as cars drive up to the terminals. Engineers saw that the ordinary type of thermostat control would not prove satisfactory for this job so they selected pressurestats to control the firing of automatic stokers. The job was further complicated by the fact that there is no shut-down period. The boilers must be fired 24 hours a day, 365 days a year, although the summer heating program is lighter than that of the winter.

Booths in both gates are heated by means of small individual units supplied with steam from a central boiler. This same boiler supplies steam for use in ordinary radiators in office and supply rooms and hot water for the employes.

The boilers in both gates are supported on steel beams over pits for convenient residue disposal. The anthracite burner at Carlisle, 18 miles from Harrisburg, automatically dumps the ash into the pit. In the West Gate at Irwin, near Pittsburgh, the bituminous clinkers are lifted out of the furnace and dumped into the pit. Both pits have below-level outside entrances to facilitate removing of the residue.

Fan and motor housings of the stokers are set below floor level in back of each boiler. The conveyors pick up the coal in steel and concrete bins located in front of the boilers and carry it to the fire through a trench covered with steel plates. This leaves the fronts of boilers clear of all obstructions.

Continuous operation since the opening of the road has proved that the heating plants are a complete success. Ticketmen are comfortable despite the high heat loss from the glass booths.

The installations were worked out by the Snively Plumbing and Heating Co., Pittsburgh, and Weber & Company, Pittsburgh, Iron Fireman dealers.

(Below) The East Gate, Carlisle, Pa. At the right of the Gate is the building which houses the boiler room. (Right) The East Gate booth is heated by rice anthracite coal fed by the stoker to the boiler.

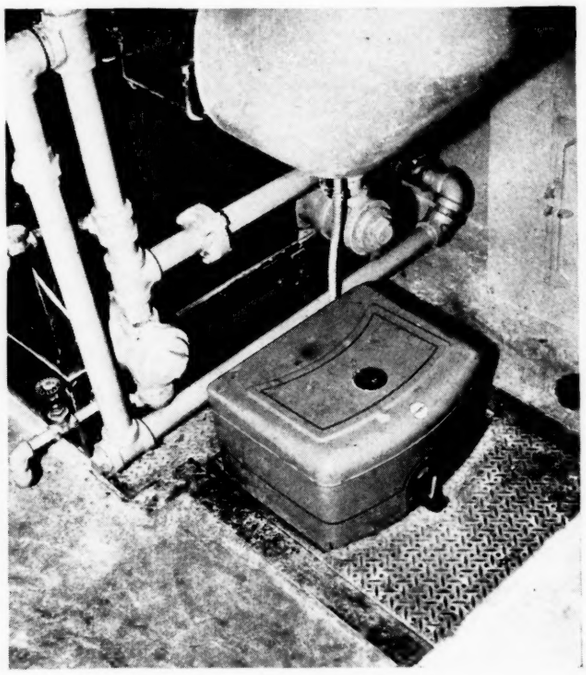


Fig. 1. The living room of the house described. The slot around the wall at the ceiling is concealed with a crown moulding.

Radiant Heating by Convection

By RICHARD BRINDLEY and ALVIN OTTUM

INCREASING interest in methods of radiant-panel heating and the fact that uncontrolled radiation losses present a problem of no little magnitude to the heating engineer, have prompted the writers to explore the possibilities in radiation control by use of a convection heating arrangement.

Basic Idea

In contrast to the conventional practice of embedding pipe in floors, walls or in the ceiling, the idea of the authors is to facilitate the gravity circulation of air and maintain a constant mean radiant temperature by use of a heating element, consisting of a non-ferrous extended surface coil, located at the baseboard level in an interior wall section of the building. The air heated by this element rises and is introduced into the room through a slot located near the ceiling. (See Fig. 3.) This slot is 2 in. wide, is located 2 in. from the ceiling, and runs around the entire room. The warm air which has been introduced at the inside ceiling is drawn across the ceiling, through that portion of the slot in the outside walls, and into the space between the studs in the exposed walls. The air then drops down through the stud spaces to a plenum chamber beneath the floor, through which it returns to the heating element to be heated again. Grilles are located in all of the window sills so that air cooled by the window is drawn into the wall space where it becomes a part of the general heating cycle.

Test Installation

A system of this type has been installed in a residence, and required only a slight modification of standard western frame construction to make the air flow possible and accommodate the equipment. The house is a typical story-and-a-half house with full basement. Frame construction is employed, consisting of an outside wall of ¾ in. redwood siding 6 in. wide, a layer of building paper, ¾ in. wood sheathing, 2 in. of glass wool insulation with vapor barrier, and with dry wall construction inside of ⅜ in. gypsum plaster and three coats of paint. The roof is of asphalt shingles on ¾ in. sheathing and with 2 in. of glass wool. Basement is of 8 in. cement blocks with a ceiling of ¼ in. gypsum plaster board. Windows are weatherstripped and storm sashed.

The first floor has a living room, kitchen, two bedrooms and bath. The second floor has a large bedroom and hall.

The heating system consists of a one-pipe hot water system with circulator, using a ⅞ in. O.D. copper main and ¾ in. O.D. copper runouts. Sweated fittings are used. The heating element is of ¾ in. O.D. copper tubing with .035 in. walls mechanically bonded to 2 x 2 in. aluminum fins. Approximately 80% of the inside walls are heated. Room control is by a conventionally located thermostat which actuates the circulator.

Fig. 6 shows the piping layout in the basement. The

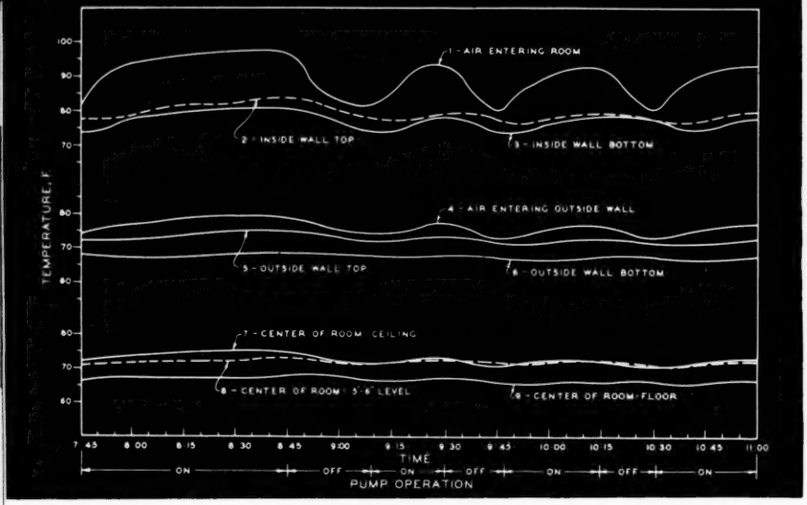

1 - AIR ENTERING ROOM
2 - INSIDE WALL TOP
3 - INSIDE WALL BOTTOM
4 - AIR ENTERING OUTSIDE WALL
5 - OUTSIDE WALL TOP
6 - OUTSIDE WALL BOTTOM
7 - CENTER OF ROOM CEILING
8 - CENTER OF ROOM 5'-6" LEVEL
9 - CENTER OF ROOM-FLOOR
TEMPERATURE, F
TIME
PUMP OPERATION
ON
OFF

Fig. 2. Temperatures at various thermostat locations during the tests.

second floor is heated in the same manner as the first floor and its air circulation is entirely separate from that of the first floor. The first floor ceiling is furred down with 2 x 2 in. strips to form the plenum chamber for the air circulation. The bathroom (See Fig. 7) is heated by a 4 ft element in the wall near the tub with the outlet into the bathroom itself. The other inside wall is warmed by an element which also serves the bedroom but allows none of the convected air into the bathroom.

Fig. 4 shows the heating element in place in an interior wall of this house. The studs were notched to accommodate this element, and asbestos and graphite were placed in each notch to insure the prevention of any possible noise arising from the expansion and contraction of the element.

A duct of approximately 22 sq in cross sectional area in each stud space provides the down draft in the exposed walls. The plenum chamber was created by furring the under side of the floor joists with 2 x 2 in. strips thus permitting the air flow either parallel with or diagonal to the joists. The ceiling slots are concealed by attractive moldings, as shown in Fig. 1.

The design temperature is —20F in the area in which the house is located. In mild weather the temperature of the interior surfaces of the exposed walls of an average house may be around 66F, but in extreme weather the same wall surface temperature commonly drops down as low as 50F. By advancing the thermostat and creating a higher air temperature to offset the increased radiation losses, it is possible to compensate for this variation. Consequently, during cold periods, it is common practice to maintain air temperatures at the breathing level of from 76F to 80F to compensate for this increased radiation from the body of the individual to the cold walls.

Tests were conducted in the living room of the subject installation with an average outside temperature of 4F.

Thermometers were located as shown in Fig. 6. The wind velocity during the tests ranged from 13 to 15 miles per hour from the northwest. Readings were taken at 5 min intervals from 5:45 p.m. to 11 p.m. The living room, which measures 13 ft on the north wall and 17 ft 8 in. on the west wall, was bare, with no rugs or furniture. Windows, of which there are two in the west wall and one in the north wall, have an area of 13 sq ft each. Slots were provided in all window sills.

The average basement temperature during the test was 49F, low due to the lack of backfill along the basement wall. The second floor was heated to 68F. Average water temperature to the heating surface was 190F. The average temperature of the surface of the interior wall panel, through on-and-off cycles, was approximately 78F. The extreme temperature of the warmed air emitting from the slot was 95F. The average temperature of the exposed wall area was 70F. The net result of these warmer surfaces was to create a higher MRT and compensate for other surfaces such

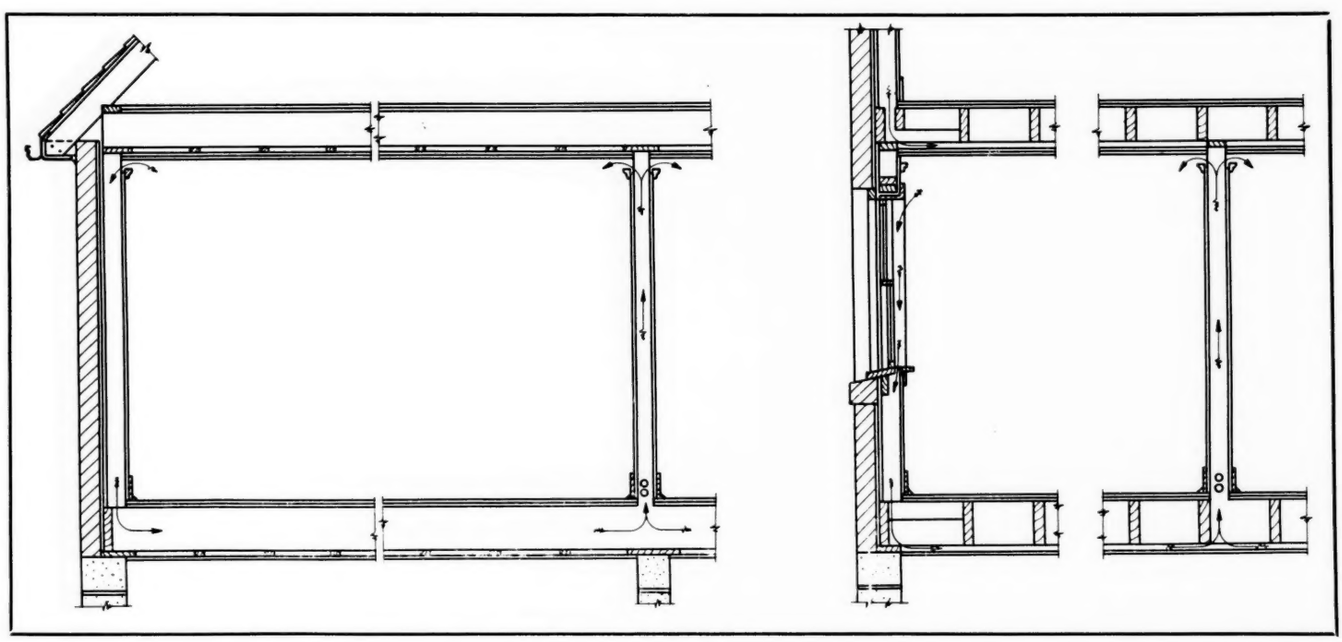


Fig. 3. Typical sections through the house described by the authors showing the location of the convectors in the interior walls and the method of air circulation.

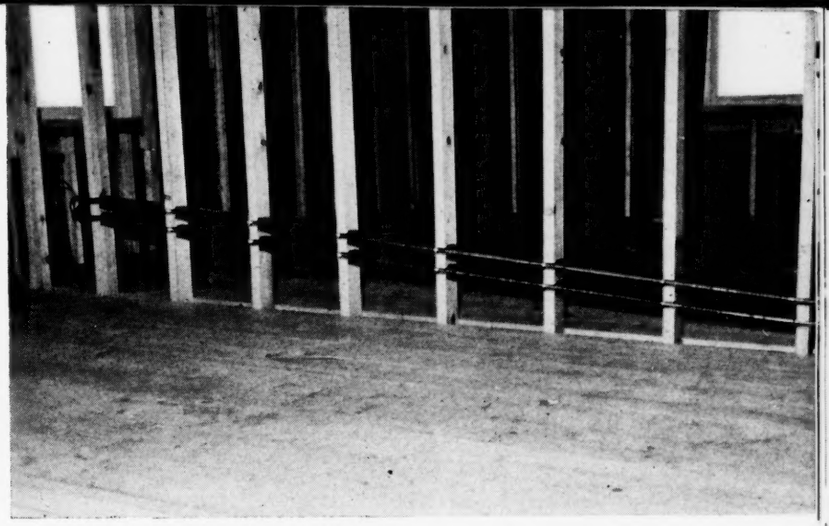


Fig. 4. One of the convector elements showing how the studs were notched to accommodate the elements.

as floor and window area which are not heated by the warmer air. The MRT was approximately 70F—and consequently a room air temperature of 71F at breathing level met the comfort requirements very nicely.

The readings are plotted in Fig. 5 and summarized in Table 1.

TABLE 1.—SUMMARY OF TEMPERATURES DURING TEST

		MAX., F	MIN., F	RANGE, F
1	Air Entering Room	98	81	17
2	Inside Wall, Top	84	77	7
3	Inside Wall, Bottom	81	74	7
4	Outside Wall, Air Entering	79	73	6
5	Outside Wall, Top	75	71.5	3.5
6	Outside Wall, Bottom	68	66.5	1.5
7	Room Interior, Ceiling	75	71	4
8	Room Interior, 5½ ft. Level	73	71	2
9	Room Interior, Floor	68	66	2

Discussion

In connection with the temperature differential between floor and ceiling (6F in our test installation), the question of stratification has arisen because the warm air is introduced into the room near the ceiling level. A much smaller temperature differential was shown between ceiling and floor than might be expected, since the ceiling radiates the heat downward and also because the slots along the exposed walls near the ceiling level induce a flow of warm air across the ceiling and into the slots, so that the warm air cannot collect at the ceiling.

As mentioned previously, the room thermostat actuates the hot water circulator. A feature of this system is that, regardless of whether water circulation has ceased or not, the air circulating cycle is continuous because the down flow along the exposed walls is induced by the cooling effect dependent on outside weather conditions. This continuous air flow makes for a uniform distribution of heat.

All of the equipment necessary for a heating arrangement of this type is available at prices within the generally accepted range. Because all of the heating elements are located on the inside walls, there is a saving in the cost of piping. Fig. 6 shows the small main of 34 ft. which makes a circuit around the portion of the installation described above. The heating elements themselves are installed immediately following the completion of framing, thus avoiding costly locating, drilling and completing installation after finished walls and floors are in place. In the application of this system to a two-story house, it is necessary to fur down the first story ceiling. The basement ceiling may or may not be furred down depending upon the owner's wishes in regard to finishing his basement.

The temperature of a house heated with this arrangement can be maintained at from 5 to 7F below general heating practice under extreme cold weather conditions. This factor represents a considerable saving in the cost of operation. Furthermore, this lower air temperature means that a somewhat higher relative humidity is maintained.

The space-saving features of this heating arrangement are apparent. The complete absence of visible equipment in the rooms has a pleasing effect.

A heating system of this kind is adaptable to any frame construction or to brick and stone construction where the walls are furred down. Any of the recognized heating mediums such as steam, hot water, vapor, warm air or electricity would serve equally well as a primary source of heat for the gravity circulation of warm air. Also, cool air for summer air conditioning can be distributed by this same arrangement.

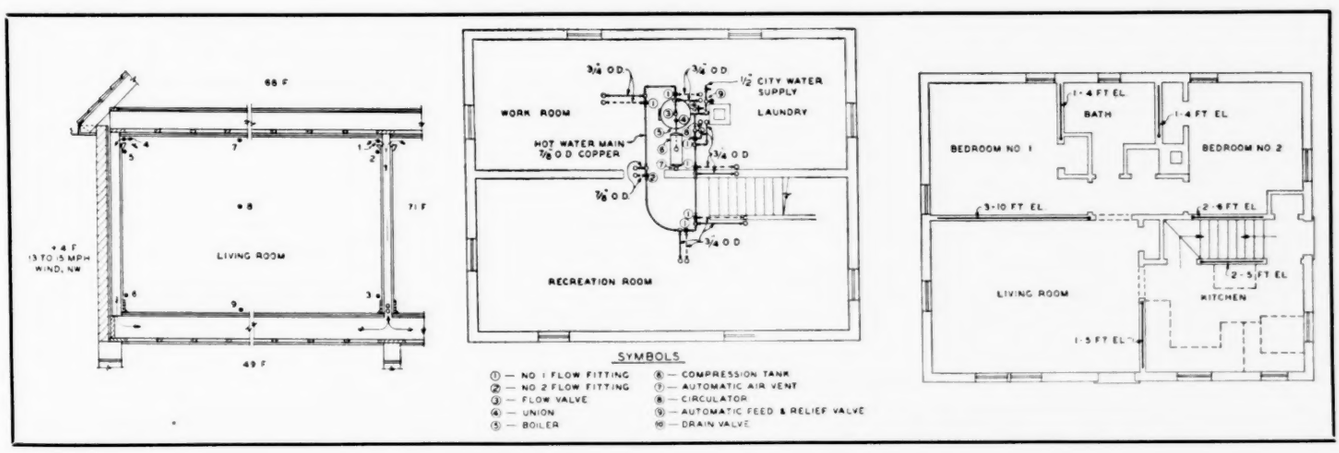


Fig. 5 (left). Location of thermostats in the living room during the tests. The readings of these thermostats are shown in the curves in Fig. 2. Fig. 6 (middle). Plan of the piping in the basement. Fig. 7 (right) Location of heating elements on the first floor of the house.

Theory vs. Practice

Increase Boiler Capacity by Reducing the Load

By T. W. REYNOLDS

IT is a simple matter to survey an old heating plant from one end to the other and a simple matter to itemize all the things that should not have been done in the way they were done and then to add the cost of their correction up to a sizable sum. However, it is much less simple to find an owner to pay for these changes. In many cases one could easily spend the total cost of a new heating system in making an existing one work to a degree said to be satisfactory, but which still falls short of Utopian performance since a certain amount of defects will remain which would not be there in a system planned anew. A system which is altered absorbs money like a sponge does water, yet fails to compete with a new one correctly designed and installed. A good combination of thought, judgment and experience is required in trouble work to use a small sum of money to best advantage where the survey indicates that two or three times the available sum is necessary.

Boilers which are of inadequate capacity need not necessarily be removed if it is possible, as it usually is, to increase in effect their capacity by reducing the heat loss in various ways. Frequently, costly boiler and radiator changes can be avoided and incidental summer-winter comfort obtained by insulating the house or only the attic, or at the very least by applying a strip of insulation continuously along the eaves in the attic where daylight glints through cracks and most of the air leaks occur. A substantial reduction in boiler load will follow.

Insulation applied elsewhere to avoid heat losses will also be of considerable help as on the boiler, tank and water heater, as well as on piping for heating and for domestic hot water supply, except that nothing is achieved in this respect where the apparent heat loss is in reality heat gain to the structure and as such does no overheating of the structure.

In addition to reducing the heat loss which obviously reduces the load, it is possible to reduce the load on the boiler in still other ways, either by separating some of the load, as with separate heating of the domestic hot water supply, or by removing portions of the load altogether, such as that occasioned by valving off of the radiators in the garage and sun porches. Ways and means of this kind keep the boiler within efficient capacity, render unnecessary its removal and economize on fuel. Heated garages are not required as much as they once were, for few persons now spend their time working in the house garage and most cars now have car heaters and the car radiator is maintained above freezing by means of a non-freeze solution.

Heating of the house garage takes a lot of fuel, especially so as few householders bother to close the garage doors which, even when closed, usually become as far as heating goes practically open after the lapse of a few years. Sagging, warping and general abuse of the doors and the action of frost on the concrete threshold make continuous wide open cracks at jambs and meeting points through which one can view the garage interior, so that a good fitting non-sticking set of garage doors becomes an exception to the general rule.

Insulation of the garage ceiling below the house floor will make the floor above more comfortable than is possible by adding radiators to the rooms immediately over the garage. Insulation so placed will also save on fuel and reduce the load and the same is true where this is applied to the floor of heated sun porches over unexcavated or open spaces. Sun porches are load increasers of considerable magnitude which, in the interest of reducing the load, should not be heated on the few real cold days and in the interest of fuel economy should not be heated during the many other days of milder weather as fuel consumption is a product of time and temperature difference. A further disadvantage in the heating of sun porches is the possible freezing of the radiators in severe weather due to partially opened valves or an outside door left open, especially where the radiators are well below requirements, for the heating of sun porches is seldom intended to be sufficient for zero weather.

In most weather a sun porch with insulated floor, but without any heat except that as received from the sun will be comfortable enough, especially so if the wall next to the heated space of the house contains glass doors and windows with an appreciable heat gain to the porch from the heated space. In this event, the radiators of the adjacent room or rooms should be large enough to allow for the heat loss to the porch.

Refrigerating Capacity of Ammonia Compressors

By WILLIAM PARKERSON

IN the April issue of HEATING AND VENTILATING, an article entitled "Power Requirements of Ammonia Compressors" presented curves designed to give the brake horsepower of an ammonia compressor, if only the speed, size and operating pressures be known. The object was to arrive at the power requirement, without reference to the refrigerating capacity.

Now it may happen, that, having found the brake horsepower from the above mentioned curves, it becomes desirable to know the refrigerating capacity of the compressor in question. Or, perhaps, the brake horsepower can be measured directly and the refrigerating capacity is the desired unknown quantity.

For the quick and easy solution of such problems, the curves presented in Figs. 1, 2 and 3 will be found helpful.

Example

The following example will demonstrate how the curves are used:

A twin-cylinder, single-acting, 7 in. x 7 in. ammonia compressor running at 218 rpm and operating at 18.27 lb per sq in. suction pressure and 185 lb per sq in. head pressure, is found to require 27 brake horsepower. What is its refrigerating capacity in tons?

From Fig. 1 it may be seen that the compression ratio, for the given pressures, is 6.06 and from Fig. 2, against a compression ratio of 6.06, may be read an over-all efficiency of 73.1%.

Now referring to Fig. 3 and entering the chart from the left at the suction pressure of 18.27 lb per sq in., proceed in a horizontal direction to a head pressure of 185 lb per sq in. At that point establish a vertical line through 1.17 horsepower per ton of refrigeration. Now reentering the chart from the right at 27 brake horsepower, proceed along an imaginary line through the *focus* until the over-all efficiency of 73.1% is reached. Then proceed horizontally to the intersection with the previously established vertical line through 1.17 horsepower per ton. At this point of intersection, read 16.9 tons of refrigeration.

Construction of Charts

The chart in Fig. 1 is too simple to require explana-

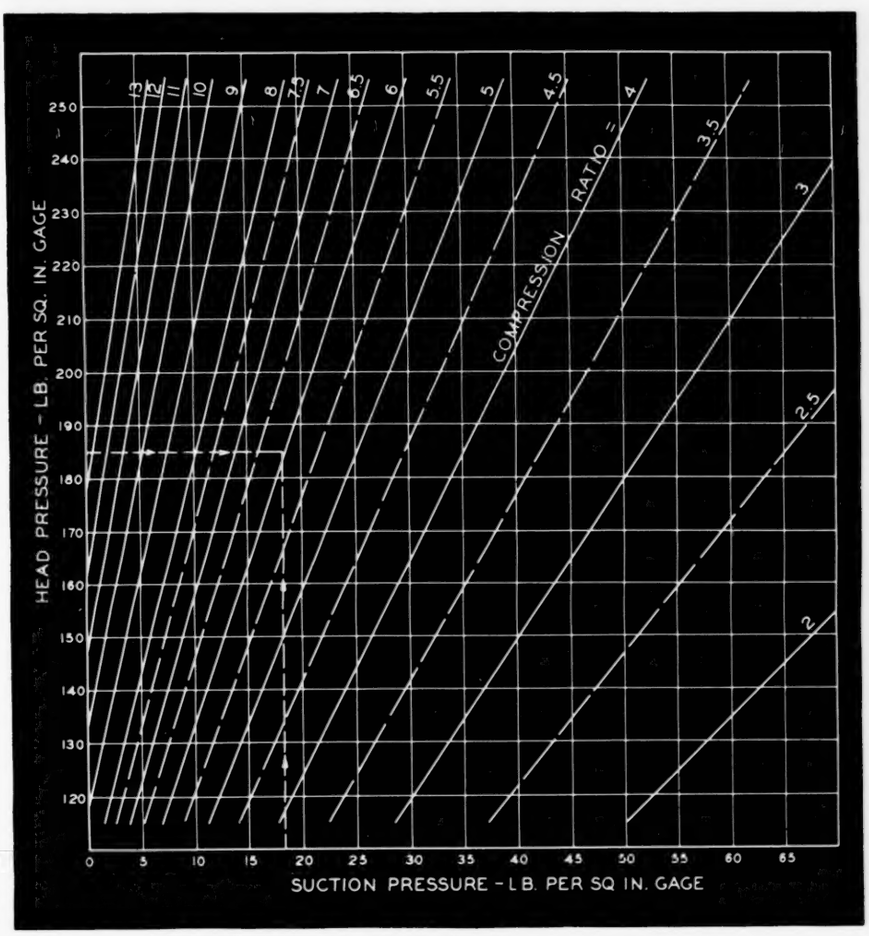


Fig. 1. Compression ratio.

Example: The suction pressure is 18.27 lb per sq in. and the head pressure 185 lb per sq in. At the intersection of the vertical and horizontal lines from the two scales find the compression ratio on the diagonal line to be 6.06.

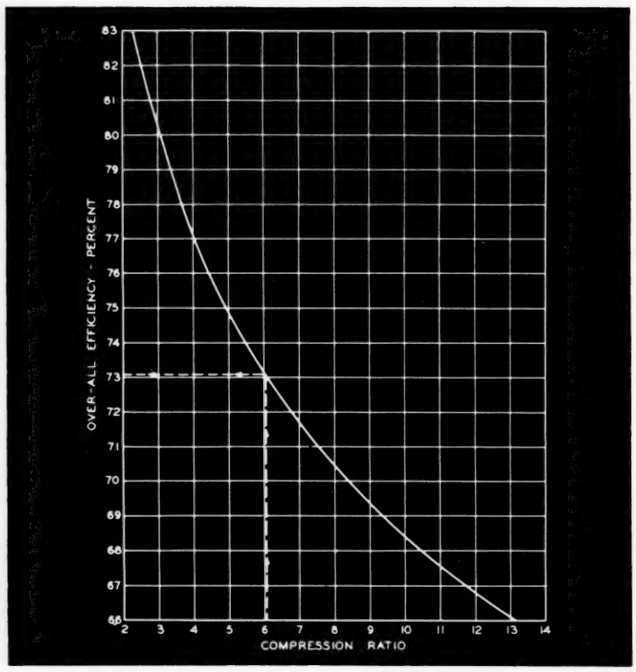


Fig. 2. Overall efficiencies of single acting ammonia compressors.

Example: The compression ratio is 6.06. To find the efficiency, locate 6.06 on the horizontal scale, move vertically up to the intersection with the curve. Move horizontally to the left scale and find the efficiency to be 73.1%.

tion. It merely shows the ratio of the absolute head pressure to the absolute suction pressure, all charted in terms of gage pressures.

The chart in Fig. 2 is the result of a comprehensive study of manufacturers' test data on three different makes of single-acting ammonia compressors. From this study it appears that the over-all efficiency varies primarily with compression ratio, being largely independent of compressor speed and other variables.

In determining the over-all efficiencies from manufacturers' test data the following equation was used:

$$E_{OA} = \frac{THP}{T} \div \frac{BHP}{T}$$

where,

CFM = Cubic feet per minute
THP = Theoretical horsepower
BHP = Actual brake horsepower
T = Refrigerating capacity, tons
E_{OA} = Over-all efficiency
H_V = Heat content of Ammonia vapor in Btu per lb.
H_L = Heat content of liquid Ammonia in Btu per lb.

The chart in Fig. 3 is composed of two families of curves—one superimposed upon the other. The tonnage lines, which extend upward to the right, are simply graphic representations of the equation

$$HP = \frac{HP}{T} \times T$$

But since the "HP per Ton" at the base of the curve is theoretical, the horsepower resulting from the above equation is itself theoretical and must therefore be divided by the over-all efficiency in order to arrive at

TABLE 1.—CUBIC FEET PER MINUTE OF AMMONIA AND THEORETICAL HORSEPOWER PER TON OF REFRIGERATION

Head Pressure In Lb Per Sq In. Gage	Heat Of Liquid In Btu Per Lb		Suction Pressure In Lb Per Sq In. Gage: 0	5	10	15	20	25	35	45	55	65
			Cu Ft Per Lb Of Vapor: 18.0	13.7	11.1	9.32	8.06	7.11	5.74	4.83	4.17	3.67
			Heat Of Vapor In Btu Per Lb: 602.1	606.0	609.0	611.4	613.5	615.3	618.2	620.5	622.4	624.0
			Volume In Cfm And Theoretical Horsepower Per Ton Of Refrigeration									
120	123.5	A*	7.522	5.679	4.573	3.820	3.290	2.891	2.320	1.944	1.672	1.466
		B*	1.384	1.176	1.020	.890	.790	.706	.562	.453	.361	.285
130	128.2	A	7.597	5.735	4.617	3.858	3.322	2.919	2.343	1.962	1.688	1.480
		B	1.459	1.239	1.080	.953	.847	.759	.614	.500	.407	.329
140	132.7	A	7.669	5.789	4.661	3.894	3.353	2.947	2.365	1.980	1.703	1.494
		B	1.526	1.303	1.142	1.009	.902	.813	.664	.549	.453	.375
150	137.0	A	7.740	5.842	4.703	3.929	3.383	2.973	2.386	1.998	1.718	1.507
		B	1.594	1.367	1.200	1.065	.954	.862	.711	.593	.497	.413
160	141.1	A	7.809	5.894	4.745	3.963	3.412	2.999	2.406	2.015	1.733	1.520
		B	1.656	1.426	1.257	1.118	1.007	.915	.758	.637	.537	.454
170	145.1	A	7.877	5.945	4.786	3.997	3.441	3.024	2.426	2.032	1.747	1.533
		B	1.725	1.486	1.311	1.171	1.057	.962	.803	.681	.578	.494
180	148.9	A	7.944	5.994	4.825	4.030	3.470	3.049	2.446	2.048	1.761	1.545
		B	1.787	1.547	1.365	1.221	1.107	1.009	.849	.723	.618	.531
190	152.6	A	8.009	6.043	4.864	4.063	3.497	3.073	2.466	2.064	1.775	1.557
		B	1.842	1.601	1.420	1.272	1.154	1.057	.890	.764	.659	.568
200	156.2	A	8.074	6.092	4.903	4.095	3.525	3.097	2.485	2.081	1.789	1.569
		B	1.905	1.657	1.471	1.323	1.202	1.103	.934	.803	.696	.606
210	159.6	A	8.136	6.138	4.940	4.126	3.551	3.120	2.503	2.096	1.802	1.581
		B	1.961	1.712	1.521	1.370	1.250	1.145	.976	.843	.733	.642
220	163.0	A	8.199	6.185	4.978	4.157	3.578	3.144	2.522	2.111	1.815	1.592
		B	2.025	1.763	1.573	1.418	1.295	1.188	1.016	.883	.772	.677
230	166.3	A	8.261	6.232	5.015	4.188	3.605	3.167	2.540	2.127	1.828	1.604
		B	2.082	1.813	1.620	1.466	1.337	1.232	1.057	.919	.808	.712
240	169.4	A	8.320	6.276	5.050	4.217	3.630	3.189	2.558	2.141	1.841	1.615
		B	2.130	1.864	1.672	1.510	1.383	1.276	1.094	.957	.843	.746
250	172.6	A	8.382	6.322	5.087	4.248	3.656	3.212	2.576	2.157	1.854	1.626
		B	2.188	1.916	1.719	1.555	1.426	1.317	1.134	.994	.877	.779

*A = Cfm per Ton. B = Theoretical horsepower per Ton.

the actual brake horsepower. This is the function of the slanting lines at the extreme right which radiate from the *focus*.

In order to plot the family of curves which slant downward from the upper left corner, the accompanying table was prepared. The A values in the table were calculated from the equation:

$$\frac{\text{CFM}}{\text{T}} = \frac{200 \times \frac{\text{Cu Ft}}{\text{Lb of Vapor}}}{H_V - H_L}$$

Then the B values were found from the relation:

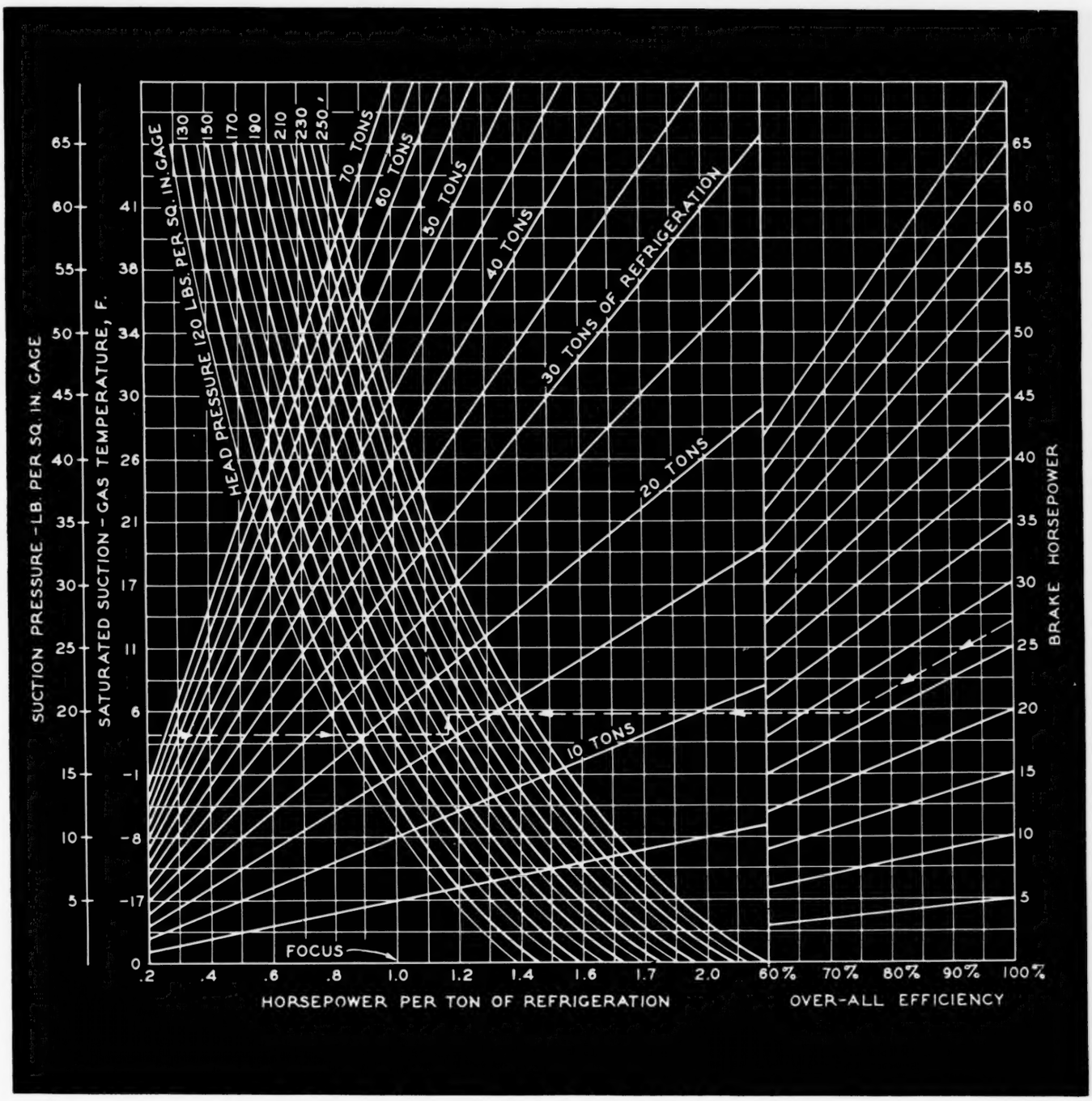
THP per ton = CFM per ton × THP per CFM

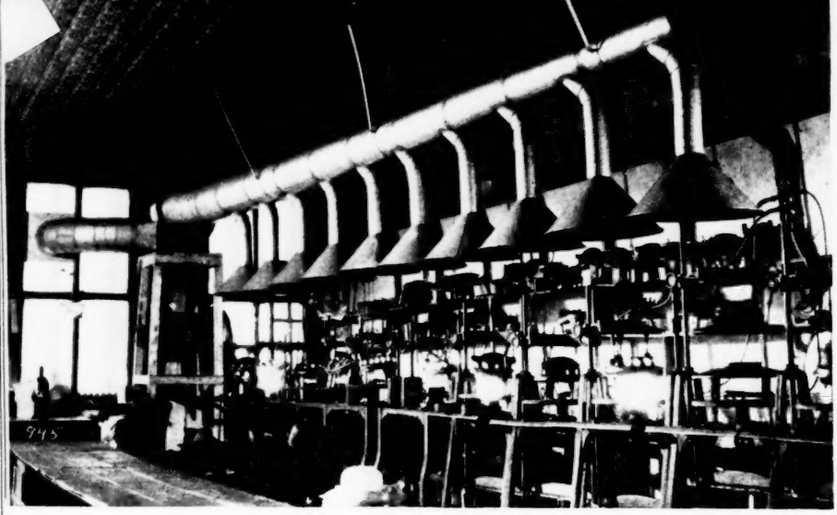
The last term of this equation was taken from the table given in the article which appeared in the April issue.

In Fig. 3, herein, as well as in the curves in the earlier article, the efficiencies were presented separately, rather than being worked into the body of the charts. This was done in order to preserve the integrity of the curves, even in the event that the writer's conclusions respecting efficiencies be found erroneous, or in the more favorable event that the user of the curves might wish to apply known efficiencies at variance with the writer's findings, in the study of a specific compressor.

Fig. 3. Tons of refrigeration for single acting ammonia compressors.

Example: Suction pressure is 18.27 lb per sq in., head pressure 185 lb per sq in., brake horsepower 27, and overall efficiency 73.1%. What is the refrigerating capacity? From the suction pressure on the extreme left scale move horizontally to the curved line indicating head pressures. Draw a vertical line through the intersection of the curve and the line. On the extreme right scale locate the brake horsepower and move diagonally parallel to the diagonals to the intersection of a vertical line from the overall efficiencies on the lower scale. From the intersection move horizontally. At the intersection of this line with the vertical line previously drawn find, on the diagonal lines, the refrigerating capacity to be 16.9 tons.





Workers on hat pressing machines are frequently exposed to carbon monoxide. Above is a photograph showing an exhaust installation in a hat pressing plant.

What the Ventilating
About Carbon Mon

CARBON monoxide and benzene are toxic gases, and consequently their presence in the air at any time or place is a matter of concern to physicians and to ventilating engineers. Monographs on the potential dangers of these gases appear in recent issues of Public Health Reports, prepared by the Division of Industrial Hygiene of the U. S. Public Health Service. The material which follows is abstracted from these articles.

Carbon Monoxide

The maximal permissible concentration of carbon monoxide in air is accepted as 100 parts per million or 0.01% by volume (0.11 mg. per liter at 25 C and 760 mm. Hg) with atmospheric oxygen not below 19 volumes percent (at 25 C and 760 mm. Hg) for exposures not exceding a total of 8 hours per day, and as 400 parts per million or 0.04% by volume (0.46 mg. per liter at 25° C and 760 mm. Hg) for exposures not exceeding a total of 1 hour daily. It should be emphasized that, with concentrations greater than 100 parts per million, increased physical activity, increased humidity, increased carbon dioxide concentration in the atmospheric air, or decreased concentration of oxygen increase the toxicity of carbon monoxide so that toxic effects may result more readily from exposure to such concentrations.

In accordance with the wide distribution and frequent occurrence of carbon monoxide as the product of incomplete combustion of coal or organic (carbon-containing) materials, such as wood, gasoline, illuminating gas, and many others, the hazards of carbon monoxide exposure exist in many industrial operations and also in our daily lives.

In the *chemical industry* this holds true especially for the manufacturing of illuminating gas, where coke-oven workers and tar distillers appear to be especially exposed; the manufacturing of ammonia gas according to the procedure of Haber and Bosch; the synthetic production of methane and methyl alcohol; and the manufacturing of soda by the LeBlanc process. Charcoal burners and carbide makers may also be exposed to carbon monoxide.

In the *metal industry* the blast-furnace workers, Bessemer-furnace men, and welders may be exposed to carbon monoxide. Carbon monoxide hazards exist also in smelting copper, lead, silver, and zinc, and in brass foundries (chargers, cleaners, coremakers, and cupola men). Blacksmiths, plumbers, and solderers may also be exposed to carbon monoxide.

In the *garment industry* felt blockers and flangers, calico printers, cloth singers, ironers, and pressers may have exposure to carbon monoxide.

In the *ceramic industry* kiln workers and brick burners may be especially exposed but some exposure appears to exist also for teazers, temperers, and mold-makers, enamel makers, and enamelers.

In the *mining industry* the main hazards appear to result from fire-damp explosions but the gases of explosives also contain more or less high concentrations of carbon monoxide, so that blasters may have a heavy exposure.

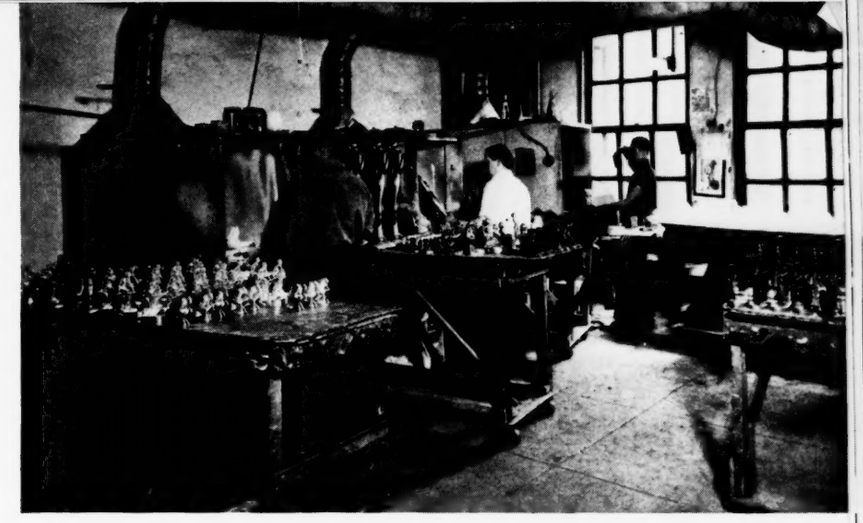
In the *electric industry* carbon monoxide hazards may exist in certain occupations such as cable splicing.

In other trades there is some exposure to carbon monoxide, for example among *lino- and monotypists* from melting pots. *Chimney masons* and *chimney sweepers* may have exposure while repairing and cleaning chimneys if these have not been ventilated.

Carbon monoxide hazards exist also in those *industries which use ovens and stoves* of different types. Here the personnel attending the furnaces, firemen, and boiler cleaners, are especially exposed, but cooks and bakers may also contract carbon monoxide poisoning if their ovens are not properly kept or constructed. Carbon monoxide poisoning has been reported repeatedly in homes from gas heaters and gas stoves. In this connection it should be pointed out that not only escaping gas but also incomplete combustion may cause carbon monoxide poisoning, as would result for instance from contact of the flame with a cooling surface.

It is obvious that the best prevention of carbon monoxide poisoning would be the prevention of any pollution of the air with carbon monoxide. This can be accomplished to a very high degree by proper engineering methods and adequate ventilation. For continued exposure the concentrations should be kept at or below 100 parts per million by volume (0.01 volume per cent). It appears absolutely necessary that the public, and especially those persons who may have occupational exposure to carbon monoxide, be instructed regarding

Engineer Should Know oxide and Benzene



Benzene, a toxic material used quite extensively in industry, is employed in the manufacture of lacquers and paints and is a constituent in certain paint removers.

its toxicity and potential dangers. Before entering any space not frequently used and suspected of containing carbon monoxide, air samples should be taken to determine the amount of carbon monoxide present.

Special attention should be paid to safety regulations. It should be kept in mind that carbon monoxide may accumulate in the upper levels of enclosures. Whenever a person must enter a room in which the presence of carbon monoxide is suspected, he should wear a safety line and an air-supplied respirator or an oxygen respirator while so engaged; he should be watched by a crew of men familiar with the dangers, signs, and symptoms of carbon monoxide poisoning.

It has been stated that the maximal allowable concentration for several hours' exposure is 100 parts of carbon monoxide per million parts of air, or 0.01% by volume, and it has been shown that 400 to 500 parts per million, or 0.04 to 0.05%, can be inhaled for 1 hour without appreciable effects. It should be emphasized, however, that, with concentrations greater than 100 parts per million, increased humidity, increased carbon dioxide concentration in the air, and decreased concentration of oxygen tend to increase the toxicity of carbon monoxide, so that toxic effects may result more readily from exposure to concentrations above the maximal allowable limit. Under certain conditions the appraisal of the carbon monoxide hazard may, therefore, also require the determination of the carbon dioxide and oxygen content and the humidity of the air.

Benzene

Benzene or benzol is a toxic material which should not be confused with benzine, a mixture of mainly aliphatic hydrocarbons. The maximum allowable concentration of benzene is at present accepted as 100 parts per million by volume of air for exposures not exceeding a total of 8 hours daily.

Benzene is used very extensively in a large number of industries.

In the *chemical industry* it is prepared by distillation of coal and coal tar and it is used for the extraction of oils and fats, in the synthesis of organic chemicals such as dyes and their intermediates, in the manufacturing of varnishes, lacquers, stains, and paints, and it is a constituent of certain paint and varnish removers. It is also used in the manufacture of linoleum and celluloid. Hazards of exposure exist also in the manufacture of other plastics and in the blending of motor fuel.

In the *rubber industry* and in many other industries it is used in certain rubber cements; a potential hazard may exist in the manufacture of rubber tires and other rubber articles, straw hats, cardboard boxes, waterproof goods, and in many other trades where this type of cement is used. The same holds true for the *artificial leather industry* where it is used with other chemicals as a solvent for nitrocellulose before this is applied to the fabric.

In the *dry cleaning industry* it played a very important role prior to the introduction of chlorinated hydrocarbons for this purpose.

In *intaglio printing establishments* it is used as a cleaning agent for the forms.

In man, inhalation of large quantities of benzene rapidly causes inebriation. This is soon followed by fatigue, sleepiness, ringing in the ears, vertigo, nausea, vomiting, headache, and staggering gait. With prolonged inhalation of large quantities, twitching, tonic and clonic convulsions, paralysis, and loss of consciousness may result. The respiration is first increased but later slowed and circulatory collapse may result. With very large doses, unconsciousness, convulsions, and death due to respiratory paralysis may occur very rapidly.

For the determination of benzene in air, samples should be taken wherever there is a known or suspected source of benzene vapors and they should be collected at the breathing level of the workers exposed, especial emphasis being given to the locations nearest the source and those in the path of the air currents carrying the vapors. They should be taken at sufficient intervals of time so that any variations in concentration will be evident, and in sufficient number to avoid any reasonable doubt of the results found. If only one sampling point is deemed necessary, samples should be taken in triplicate, but if numerous locations are to be sampled, representative points may be selected among them.

Benzene may be determined in air by passing it through a nitrating mixture and subsequent distillation with steam of the dinitrobenzene formed. After neutralization of the acid solution the dinitrobenzene may

be determined titrimetrically by means of titanous chloride or colorimetrically or according to the procedure of Schrenk, Pearce, and Yant.

Data regarding the determination of benzene in air are not very numerous but the report of Elkins indicates that such determinations deserve more attention, inasmuch as he found that of approximately 200 determinations made in various Massachusetts industries 68% showed concentrations above 75 parts of benzene per million parts of air by volume. Occasionally much higher concentrations may be encountered, as illustrated by the report of Bowditch and Elkins who found in the compounding room of one artificial leather plant concentrations of 160 and 190 parts per million, respectively, and in another plant an average of 200 parts per million. Winslow even found concentrations from 700 to 1800 parts per million in certain operations.

Three thousand parts of benzene per million of air are reported as being tolerated by man for ½ to 1 hour; 7500 parts per million are dangerous after ½ to 1 hour, and 20,000 p.p.m. is fatal after 5 to 10 minutes.

Studies on concentrations, dangerous with continued exposure, show that concentrations of 100 parts of benzene per million parts of air are generally safe but that they may occasionally cause toxic symptoms with sufficient length of exposure in susceptible individuals. Higher concentrations become rapidly dangerous, and fatal accidents have been reported from concentrations of 1000 parts per million and less.

In order to prevent benzene poisoning, cleanliness of the operation, especially regarding spilling of benzene or benzene-containing materials, is of great importance. The pollution of the air should be prevented by using closed operations whenever possible and such operations should be inspected regularly to insure against leakage and breaks. Whenever such enclosures have to be entered, it should be made certain that they are free from benzene. In case of doubt they should not be entered without proper safety appliances such as air-supplied masks and safety belts. Such work should be performed in the presence of supervisors who are familiar with the potential dangers and the first-aid measures.

In those operations where benzene is used as a solvent and where the pollution of the air by evaporation can hardly be avoided, proper local exhaust ventilation should be provided. Where benzene is evaporated at room temperature, air removal with down draft has been recommended. Where localized heat is applied, hoods or enclosures should be provided with up-draft local exhaust ventilation of sufficient intensity and sufficiently close to the source of contamination to insure complete removal of the benzene vapors.

An Unknown Factor in Long-Range Weather Forecasting

There are ten long periods in the radiation of the sun. Each of these has directly observable effects on the temperature and rainfall of the earth, but this varies with place and season and there is some as yet unknown factor which complicates long range weather forecasting.

These most recent conclusions from the work of the Astrophysical Observatory of the Smithsonian Institution were announced late in May by Secretary Charles G. Abbot. They may bring a step nearer the day when useful weather forecasts may be made for several years ahead based upon solar observations.

The sun's radiation also varies irregularly from day to day. These variations attend the sun's 27-day rotation, for the sun's surface has hot spots as well as cold spots upon it. Columns of finely divided matter shot from sun-spot regions appear to bombard the earth and veil the sun slightly when such sunspots are exactly central. Thus both increases and decreases of the sun's radiation affect us as the sun rotates.

An increase in the output of the sun, especially if of short duration, does not necessarily mean an increase in the temperature of the earth as a whole. Local conditions, such as cloudiness and location with respect to prevailing winds, have profound effects. In the past Dr. Abbot has been puzzled by apparent "changes of phase" in the weather effects of the long periods in solar variation. Almost precisely opposite weather results would sometimes ensue from the same solar phenomenon.

Recent work has convinced him, however, that this is explainable. It depends on the season of the year. For example, he says, take an 8⅛-month period—one which he actually has found in the solar variations. Every time it recurs in the same season it will have the same effects at a given station, so far as it itself is concerned. Other simultaneously operating solar variations may, of course, partially modify the effects.

The solar periods now listed by Dr. Abbot range from 8⅛ to 273 months. The latter, about 23 years, appears to be the major period in which all the others repeat themselves and the most successful long range forecasts to date have been based upon it. They have been reasonably accurate for 2 or 3 years in advance.

Dr. Abbot has analyzed temperature and precipitation records for Copenhagen, Vienna, and New Haven for the past 140 years and found that solar periodicities continued with unaltered phase throughout this period. They were sufficient to account for all departures from normal temperatures.

Dr. Abbot gives examples of fairly successful weather forecasts 5 years in advance. These are made by finding the average effect of each of the ten long solar periods on weather for 50 years back. These separate effects are then combined for the 5 years to come.

Considerable success, he believes, might be achieved in detailed temperature and rainfall predictions for 2 weeks in advance, based on the changes in radiation reaching the earth because of the 27-day rotation of the sun on its axis. But this would require a sufficient number of cooperating solar observing stations to secure highly accurate solar radiation measures every day in the year. With the three stations now available in New Mexico, California, and Chile, cloudiness prevents the observation of the sun on many days of the year.

AIR CONDITIONING MAINTENANCE SCHEDULE

CENTRAL SYSTEMS

REFRIGERANT CIRCUIT CONTROLS—the part of the system through which the refrigerant circulates including the compressor, connected piping and valves, condenser receiver, and the evaporator. The controls consist of such devices as thermostatic expansion valves, switches and regulators with automatic cut-outs and solenoid valves for water and refrigerant.

DAILY—System should be inspected for overheating of the moving parts, "knocking," excessive pressures in the system of piping and vessels. The proper cutting in and cutting out points of machines should be noted. Any evidences of sticking of the expansion valves should be noted since such sticking is usually caused by moisture in the system. Any signs of leakage should be traced to their source.

MONTHLY—On monthly inspections the refrigerant circuit should be checked for leaks of the refrigerant. The standard halide refrigerant gas leak detector is recommended for this purpose. Also look for oil leaks around packings and water leaks throughout the system. Scale traps should be checked. Purge valve should be opened or the system should be purged through the means provided. Check thermostatic gas-filled bulbs for tightness against pipes and moisture between the bulb and the pipe; moisture may freeze under certain conditions and break the contact necessary for good operation of such devices. Remove the covers from all pressure switches and such control mechanisms at least once a month as loose screws, springs, and contacts will cause trouble if not checked in time.

YEARLY—Safety devices such as relief valves should be removed and tested unless it is required more frequently by local ordinances. Valves suspected of leaking should be examined for wear. Packings should be inspected. It is assumed that at the time of the yearly inspection the system is out of service so that parts normally inaccessible can be dismantled to check for wear. A summation of the year's record should be made at this time including the notes made of the yearly inspection.

CONDENSING WATER CIRCUIT—the part of the system through which the condenser cooling water circulates. It consists of condensers, water piping, floats and valves. If the water is recirculated it may include spray or cooling ponds, cooling towers, settling tanks, and collection pans; or it may include an evaporative type condenser.

DAILY—The condition of the water should be checked for corrosive tendencies. Temperatures should be taken daily since they often are indications of the cleanliness of the system. Quantity of makeup should be recorded daily when means are at hand to do so. Float valves should be inspected daily since improper functioning of floats may result in waste of water. Leaks, even though not serious, should be noted.

MONTHLY—Sumps, tanks, and collection pans should be checked for slime formation and algae growth, and for general cleanliness. Water samples should be taken for chemical analysis. Spray nozzles should be inspected for plugging. Accessible parts of evaporative type condensers should be given a thorough inspection each month for accumulations in the air and water passages.

YEARLY—Water should be drained from all parts of the system so that all internal parts can be properly inspected. The circulating system should be checked for clogging and partial stoppages. Any valves suspected of leaking during operation should be dismantled for inspection at this time. All internal surfaces should be carefully scrutinized for corrosive action and scale formation. There should be a general summing up of the yearly record at the time of annual inspections. All items carried over from the other inspections will now become a part of the yearly report.

COOLING WATER SYSTEM—the circuit through which the refrigerated water passes. Includes storage tanks, evaporators, piping, spray units or washers, and collection pans and heating coils.

DAILY—The storage tank should be checked for water level and condition. Floats should be inspected daily. On new systems the spray nozzles in the units should be inspected daily for plugging as small particles of dirt find their way to the nozzles for the first month or so of operation.

MONTHLY—The storage tank should be drained monthly for inspection; the large amount of dirt washed out of the air may cause plugging if a careful check is not made. After daily inspection of the spray nozzles has been dropped it should be made monthly. A water sample should be taken for chemical analysis. Drains should be inspected.

YEARLY—Water should be drained from the cooling water circuit for the annual inspection. This inspection should include a check of evidences of scale formation and corrosion.

FILTERS AND DUCTS—the part of the system which cleans and carries the air of the system. Because of their structural nature they require less attention than other parts of the system.

DAILY—Static pressure drop across filters should be checked.

MONTHLY—Filters should be inspected for dust accumulations. Sections should be removed at random from sectional filters each for checking. Insulated duct work should be inspected monthly for traces of moisture getting between insulation and duct walls.

YEARLY—The general condition of filters should be determined. Ducts are inspected at this time for defects and leakages. Dirt accumulations are noted, and any abnormal conditions investigated.

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AIR CONDITIONING MAINTENANCE SCHEDULE

CENTRAL SYSTEMS—Continued

ROTATING APPARATUS—those parts of the air conditioning system, such as pumps, compressors, blowers, motors, and the controlling devices which convert or assist in the conversion of electrical energy into refrigeration.

DAILY—Motors should be given a daily "once over" with particular attention being given to automatic starters and contactors. Any arcing should be noted. Such equipment properly cared for seldom gives trouble.

MONTHLY—Note the condition of brushes, protective devices and oil levels. Belt tensions should be checked and any apparent misalignment or abnormal wear should be fully investigated. Blower bearings should be checked for proper adjustment. Pump packings should be inspected monthly for leakage. The casing covers of motors used with induced draft cooling towers should be removed once a month for inspection. Where gears are used on this type fan they should be inspected once a month.

YEARLY—In its turn each piece of equipment should be taken out of service for a thorough annual inspection. Clearances should be checked on reciprocating parts. Wear of bearings should be checked. Evidences of stress should be noted and possible cracks should be investigated. Each lubricating system should be examined for dirt and grit. Important safety devices are tested at this time. A report should be summarized on the general condition of all the rotating machines, the drives and the driven units.

UNIT AIR CONDITIONERS

UNIT AIR CONDITIONERS—self-contained air conditioning systems that are built in compact units.

DAILY—Since these units are as near "fool proof" as it is possible to make them, inspection becomes co-incidental with "operation."

MONTHLY—The system should be checked for leaks with a standard halide gas leak detector. Belts should be inspected each month for signs of abnormal wear or pulley misalignment. The builder's instructions on purging should be followed. Oil levels are checked each month. Knocks should be investigated.

YEARLY—A check should be made on the water being used to determine its condition. The service of the small unit does not warrant other than reasonable precautions to see that clean water is at all times supplied to the system. At the annual inspection the water in the system should be drained and the various parts examined for corrosion and scale. Safety devices should be removed and checked and their condition noted. An over-all "condition" record should be made for the year. In some cases it is recommended that a general check-up or inspection be made of unit systems after a stipulated number of service hours; quite often the number of service hours is much longer than a year. The recommendations based on service hours should always be followed because the maintenance requirements are a function of hours of actual operation which determines the life of individual parts of the unit.

The table on this and the other side of this sheet is designed to serve as a guide for maintenance inspection for air conditioning equipment. In general inspection should be divided into daily, monthly, and yearly periods.

Daily inspections are those that have to do with checking water levels, water conditions, heating up of parts, hand-oiling and whatever may be termed a daily once-over.

Monthly inspections are usually those specified by the manufacturer as routine checks on oil levels in reservoirs, checks for leaks of the refrigerant, oil, and water, cleaning of electrical apparatus, filters, spray nozzles, collection pans, and checking of control devices, belt tensions, scale traps, and purging.

Yearly inspections require the opening up of condensers for examination, dismantling of machines, and any inspections which require the apparatus to be shut down for prolonged periods. The grouping in the table has been arranged in what is considered a logical order for efficient work.

It might appear that the schedules outlined above are an attempt to reduce inspection to a rigid routine. No such intention was in mind. Quite the contrary, the grouping was definitely arranged to permit flexibility for physical reasons unique to any given plant. Most failures of equipment are, without question, preventable. A pulley that causes frequent replacements of belts is being neglected by somebody and the relief valve that fails to open the one time it is required to has been a forgotten piece of equipment for some time. Even in an extreme case it may take a dollar's worth of maintenance to prevent a dollar repair; the maintenance dollar, however, is the wiser one because the failure that necessitated the repair may be accompanied by intangibles —not easily evaluated in terms of dollars and cents.

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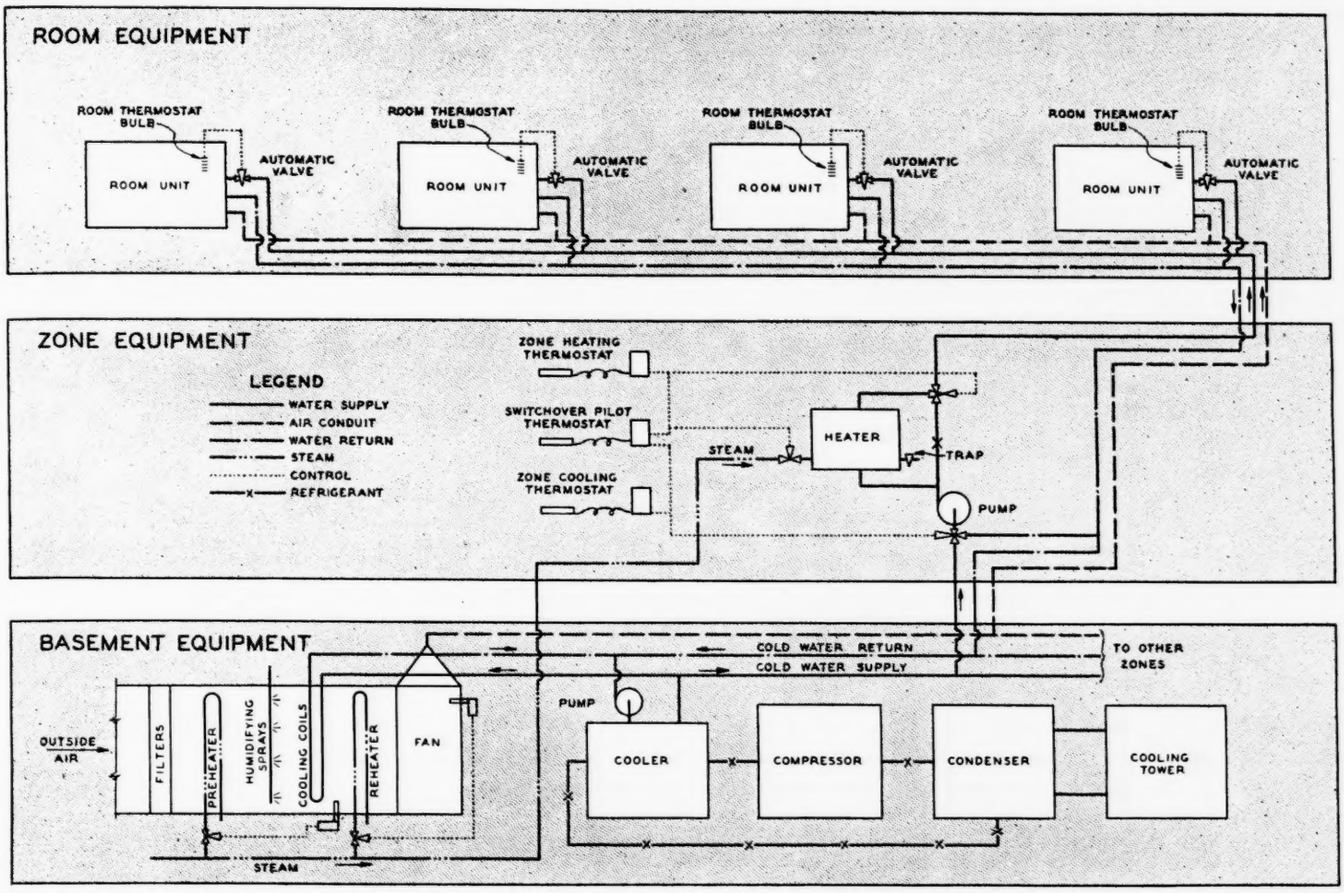


Fig. 1. Schematic diagram, not to scale, illustrating the general arrangement of the Carrier Conduit Weathermaster system. Some accessory equipment has not been shown so as to simplify the drawing and better to illustrate the basic idea.

New Comfort Air Conditioning System Uses 8-in. Air Pressures

THREE hundred and fifty architects and engineers, assembled at a Producers' Council banquet at the Hotel Pennsylvania, New York, June 12, heard Dr. Willis H. Carrier, air conditioning pioneer, describe the new Carrier Conduit weathermaster system of air conditioning. Dr. Carrier reported that the new system had already been tested and proved successful at the Bankers Health and Life Insurance Company building at Macon, Georgia.†

Intended primarily for apartments, hospitals, hotels, office buildings, and other multi-room structures, the new system cuts the required space for air ducts, it is reported, to 15% of what was formerly needed by using light weight pre-fabricated ducts of small diameter through which conditioned air is distributed under relatively high pressures and velocities.

Dr. Carrier reported that in addition to the Macon installation five other installations are under construction throughout the country.

The design and structural features of the new system can be summarized in three points as follows:

First, the dewpoint of the air is controlled in a basement (or apparatus room) conditioner. At the same time the air is cleaned and humidified, if necessary; second, this air is distributed to the rooms to be conditioned through small diameter conduits at a relatively high pressure and high velocity; third, at the room unit the high pressure air passes through an injector arrangement inducing the flow of room air into the unit and over heating or cooling coils supplied with cold or hot water, depending on the season, from the basement or apparatus room. There are no return air ducts since only the ventilation air is brought into the room and a quantity equal to this amount is allowed to leak from the room and be picked up by a corridor exhaust system.

The system is shown in schematic form in Fig. 1 which is not to scale and which shows how the system would operate with one zone. In order to simplify the system for purposes of getting acquainted with it much of the accessory equipment has been omitted from this drawing. The following will explain its operation.

Room Units

The room unit, a section of which is shown in Fig. 5, receives the primary or high pressure conditioned air at its base. This air passes around sound absorption

†This installation is described in the article beginning on page 54.

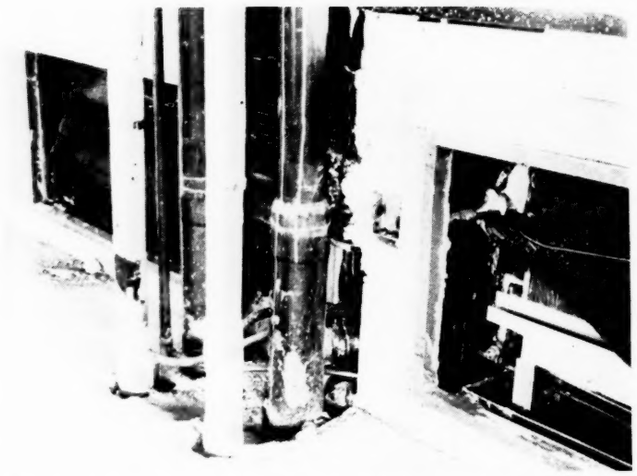


Fig. 2. An actual installation of an air conditioning riser group, with air conduit in right foreground, insulated water supply and return in foreground, and drain in background.

Fig. 3. One conduit riser group serves each bay. In this case two room units are served from the riser group between the two units.

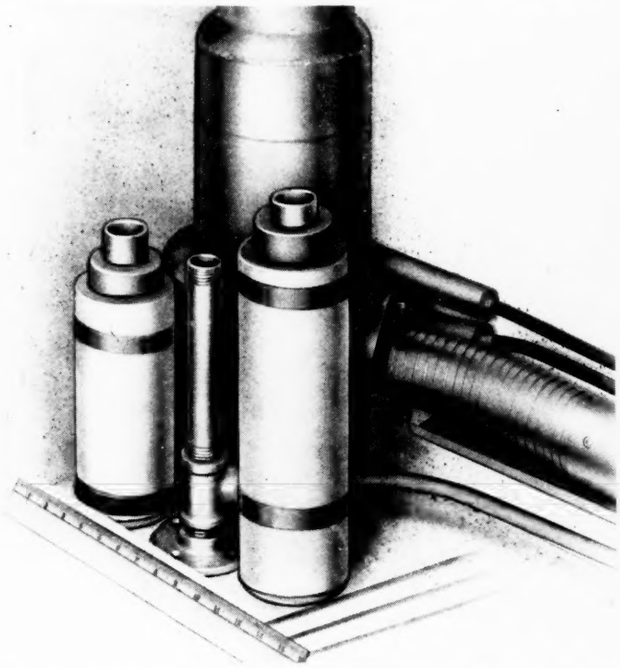


Fig. 4. Model cut-a-way section of the conduit system, showing detail of the take-off supplying air to the room unit.

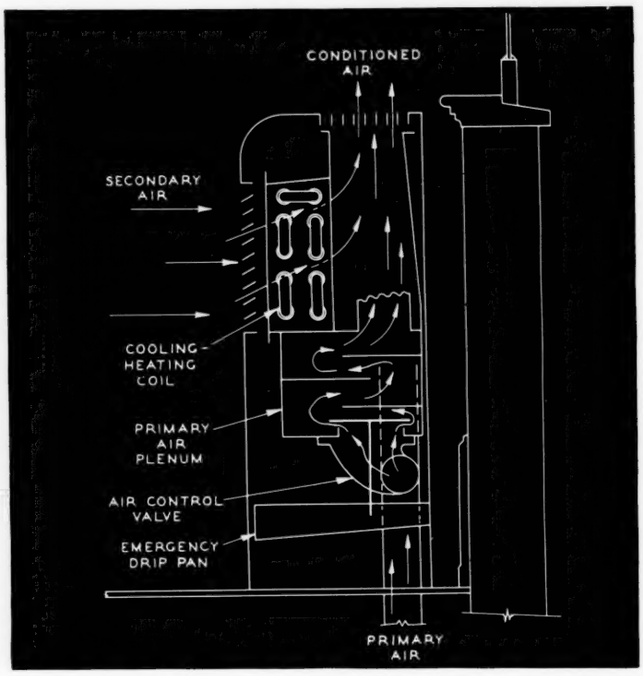


Fig. 5. Section through a room unit. Room or secondary air is induced to flow across the heating or cooling coils by the ejector action of the primary air.

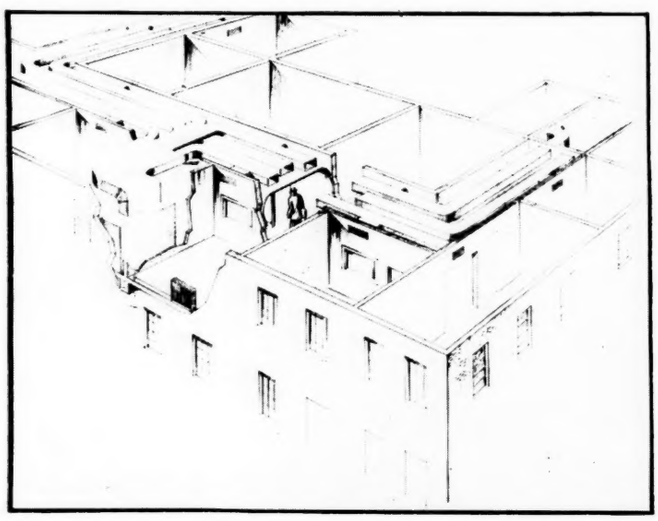


Fig. 6. An artist's drawing showing the headroom ordinarily required for ducts in a conventional central air conditioning system.

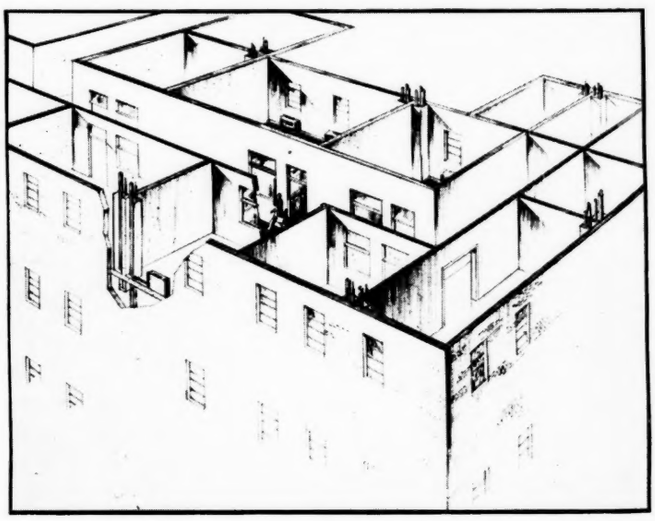


Fig. 7. In this view the artist shows the same building equipped with a conduit system which frees the corridor of ducts.

baffles in a plenum chamber and is ejected from nozzles at high velocities. This induces a flow of secondary air from the room into the unit through a grille in the front of the room unit and over the heat transfer coils through which hot water is circulated during the heating season and chilled water during the cooling season. The velocity of the primary air leaving the nozzles is such that the secondary and primary air are thoroughly mixed when they leave the top of the unit. The quantity of primary air supplied, which is equivalent to the amount of ventilation air needed, is constant. The room temperature is regulated by the action of a thermostat in the room on a valve controlling the quantity of hot or cold water allowed to circulate through the coils. This valve is operated either automatically or manually.

The water flow control valve is of the by-pass type, and if the valve is closed from full open position and coil water flow reduced, the by-pass is opened a proportional amount, so that the total water quantity flowing to and from the unit remains constant. In addition, there is a balancing valve on the water supply and return for use as an emergency shut-off for disconnecting the room unit without disrupting the balance of the system, and which also acts as a balancer in the event that the room load is changed due to changes in the number of occupants, lighting, and so on.

A condensate drip pan is located under the coils for collecting condensate should any dehumidification take place under unusual conditions.

It is important to note that excepting under unusual conditions there is no dehumidifying taking place in the room unit, no filtering and no humidifying. The room unit controls only the dry bulb temperature.

Zoning and Zone Equipment

It is possible with this system not only to heat in the winter and cool in the summer but to cool one zone while another is being heated; this, for example, is not only convenient but called for. In the spring and fall, especially in modern buildings with large glass areas, there are times when, for example, the north side of the building may require heating while the south or west may require cooling.

Each zone has a circulating pump to handle the water through the piping in that zone. In addition there is a heater (or heat exchanger) in each zone which is supplied with steam either from the building's boiler or from district steam lines. Admission of steam to the heater is under the control of an outside zone thermostat. During the heating season the water circulating to the room units returns from the units, is reheated in the heater, and returns to the room units without ever leaving the zone apparatus room. In the summer or cooling season chilled water from the main apparatus room or basement by-passes the heater; the flow of this chilled water to the units is regulated by another outside zone thermostat.

Basement Equipment

In the basement or main apparatus room is located the refrigerating machinery and main conditioner. Steam connections are provided to a pre-heater and reheater and chilled water is circulated from the refrigerating machinery to cooling coils. Water is circulated through humidifying sprays. The only air handled by this main conditioner is outside or ventilation air which is conditioned so far as cleaning, humidifying and dehumidifying is concerned. The fan then forces this air into the conduit for distribution to the conduit system.

Conduit System

The conduit is a steel tubing fabricated in the factory to floor-to-floor lengths and rust-proofed.

Fittings and branch connections are standardized so that all risers and connections require no sheet metal fabrication, but are assembled on the job. These risers and connections are slipped together like fishing rods. Ordinarily the largest pipe size is 6½ in. and this will usually take care of from 12 to 15 floors from one riser. Such conduits can be placed, together with the water piping, in the usual pilasters of the standard office building without any enlargement, or in old buildings they may either be placed in the pilaster or enclosed in a small space in a corner adjacent to the pilaster. The connection from the risers to the room units are flexible to allow for expansion, contraction and ease of adaptation, and are 3 in. in diameter so that they can be concealed in a metal baseboard, or in new buildings may be recessed back of the furring.

Air flows through the conduit at pressures ranging as high as 8 in. of water and at high velocities. The power consumption, however, is said to be much less than with conventional systems since (1) the air does not have to be returned and (2) only ventilation air is being handled.

Fig. 4 illustrates a Carrier Conduit system assembly and shows the air conduit and its take-off to a room unit, together with the insulated supply and return water piping and the small drain pipe.

The manufacturer claims 26 advantages for the conduit system but the important ones of these may be summarized as follows:

1. *Space Saving.* The conduit system, with its small supply piping and no return duct, is said to use only 15% as much space as the conventional duct system. Consequently, where space is rentable or usable, particularly in large or tall buildings, this becomes an important feature.

2. *Simplicity of Installation.* This advantage is claimed because of the reported ease of installing the conduit, the absence of return grilles and return ducts, and the absence of machinery in the room units scattered throughout the building.

3. *Lack of Odors.* Since no dehumidification takes place in the room unit, odors resulting from the collection of water in drip pans are not present.

4. *Flexibility and Uniformity.* The zoning accounts for flexibility of temperature control which, it is claimed, can result in a considerable saving in fuel costs. Uniformity results from the fact that humidity is controlled at a central apparatus in such a way that air conditioning and ventilation are independent of the temperature control.

* * *

The application of a Carrier conduit system to an actual building is described in the article beginning on the next page.

Georgia Office Building Air Conditioned by New Conduit System

By GEORGE W. MEEK†

THE eleven-story Bankers Health and Life Insurance Co. building in Macon, Georgia, is of reenforced concrete construction, and due to its location in the tornado belt the structural design is considerably more rigid than, and differs considerably from, the construction used in the northern part of the country. The majority of buildings of this size and type have the so-called wet-columns located at or near the interior columns of the building but due to the special construction it was necessary to place these on the outside edge of the building and combine them with the furred spaces that were to be used for the air conditioning services. Consequently, the pipe chases on the outside wall contain not only the air conditioning water supply and return risers and the air conditioning conduit, but also the roof drains, domestic hot and cold water, as well as toilet facilities.

The first floor of the building is given over to small shops and a drug store while the upper ten floors will eventually be used as general and private offices. Within the building there is a total of seven air conditioning fan systems all of which are supplied from a common refrigeration plant in the basement. There is an additional fan system located on the fifth floor of the existing and adjoining building which serves a broadcasting studio. The lower portion of this existing building is supplied with air conditioning from the Carrier Conduit Weathermaster system which replaces the existing system of radiators.

†Development Engineer, Carrier Corporation.

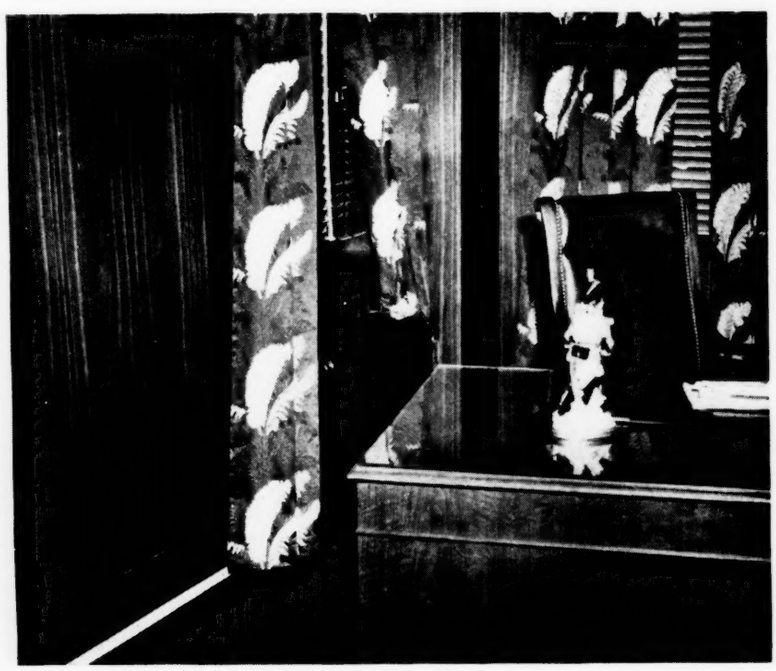
Fan System

Outside air for ventilation is drawn into the basement and forced into the conduit system by two Buffalo super limit-load fans each handling 7000 cfm. These fans are located on a spring mounted concrete base and are driven through vari-pitch pulleys by 10 hp motors. The fans were selected for 7 in. total pressure. Approximately 2 in. of this pressure is required in the outside air intake louvers, outside air ducts, non-freeze pre-heater, filters, cooling coils and humidifying sprays, and re-heater. Approximately 4 in. of pressure is required to overcome the friction and other resistance losses in the basement supply headers and the eleven-story risers. This results in a pressure of approximately 1 in. behind the primary air nozzle located in the room unit.

Located at the fan discharge are two 14 in. diameter conduit headers which distribute air to the various conduit risers. Starting at the fan discharge and continuing for a distance of 16 ft, each basement header is lined with 2 in. of mineral wall covered with flameproof muslin and ½ in. mesh hardware cloth. This arrangement effectively serves to absorb the noise generated by the high pressure fan in which the wheels are travelling at slightly less than 13,000 fpm tip speed.

Refrigeration System

Cooling for the offices and floors is supplied by three 50-ton refrigerating compressors located on a common spring mounted concrete and steel slab. Each com-



(Left) Bankers Health and Life Insurance Company, Macon, Georgia. (Right) Weathermaster installed in office for year round conditioning. Connections are concealed behind metal baseboard.

pressor is fitted with capacity control so that capacities may be varied by six increments of 25 hp each. This extreme flexibility is necessitated by the wide variation in loads that may be occasioned by the drug store, retail shops, broadcasting studio, and office building proper. The compressors were spring mounted so as to eliminate any chance that vibration might pass through the building structure and affect the operation of the broadcasting studio.

Pumping Equipment

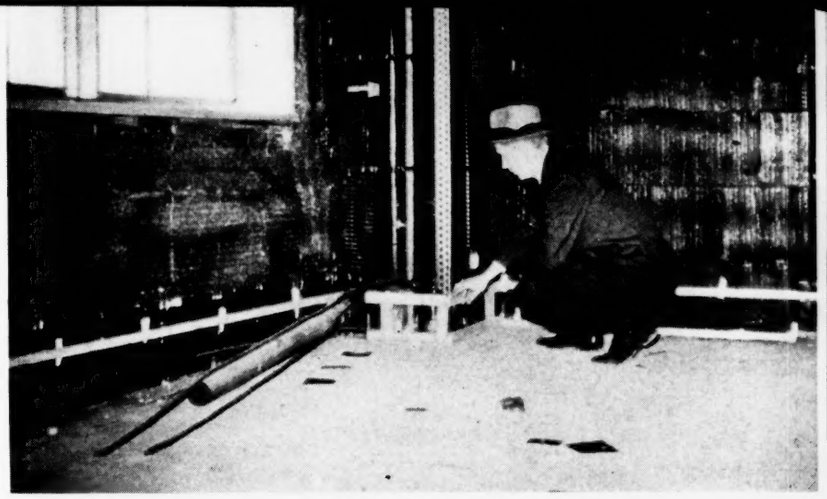
Among the pumps the largest is the one used for condenser water or cooling power use. This pump handles 450 gpm against a 65 ft head and is driven by a 10 hp motor. The small, close-coupled, zone pumps supply water directly to each zone and merely overcome the friction loss in the piping system as well as the friction through the coils in the room Weathermasters. Use is made of a main chilled water circulating pump which forces water through the cooler and supplies it to the basement dehumidifying equipment, as well as to the various zones. In the winter, when no dehumidification is being done in the basement, it is thus possible to shut down this large pump and operate the zone pumps on closed systems. The closed water heaters are located in the zone pump piping system and in a separate small pumping system which supplies the stores. The closed water heater for the office portion of the building handles 150 gpm and, with 5 lb steam, was designed for a leaving temperature of 165F with water entering at 145F.

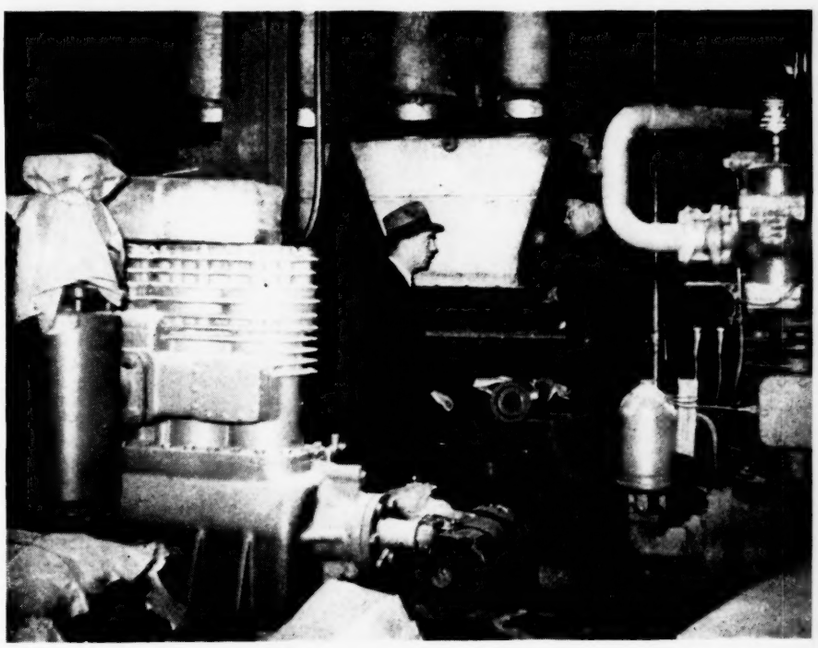
Miscellaneous Equipment

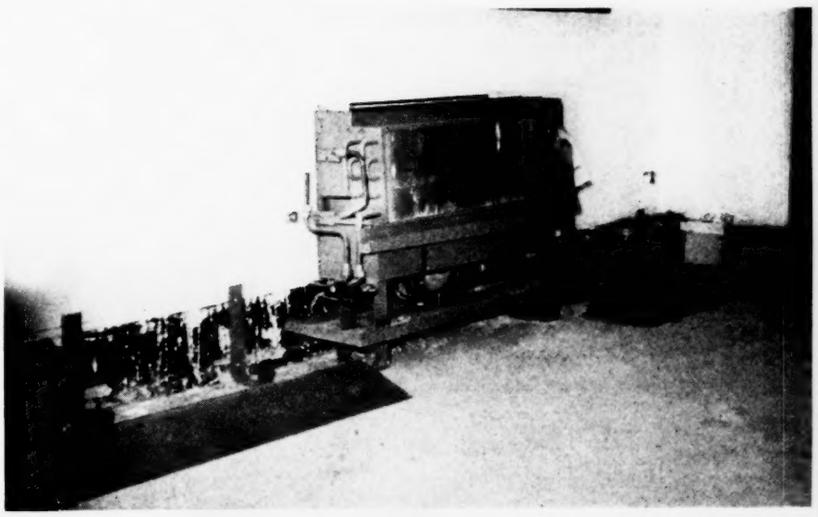
Located in the basement adjacent to the fan is a surface dehumidifier equipped with an 8-row cooling coil. In the same dehumidifier casing is mounted a recirculating spray system for use as a winter humidifier. After the outside air is drawn through 20 replaceable type filters it is passed over a non-freeze preheater. While not located in the basement, the cooling tower is closely associated with the basement equipment. The cooling tower is carefully built into the tower portion of the building and cannot be detected from the street level below. It is of the forced draft type and utilizes two 6 ft gear driven propeller type fans.

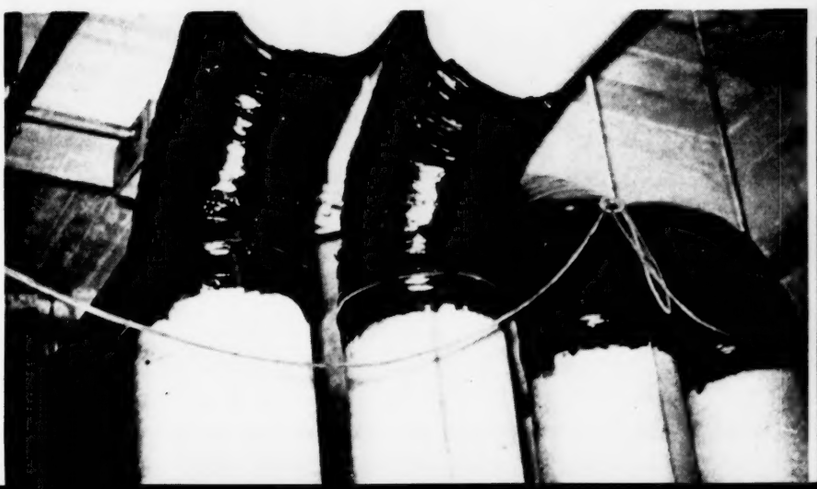
Air Distributing Equipment

The fans and basement conduit headers were mentioned above. Connecting to these basement headers are riser pipes 6½ in. in diameter. These pipes or conduits are of arc-welded construction and are made absolutely air tight. These conduits continue up for the first four floors and then are reduced in size to









(Top) Riser group furred in corner prior to plastering, with branches extending along baseboard.

(Upper center) The three 50 hp compressors and air headers at fan discharge.

(Lower center) Room unit during construction. Note metal baseboard supports and covers.

(Bottom) These four basement air headers with sound absorbing material supply ventilation air for the eleven floors.

5¼ in. diameter. They then continue for another four floors before being reduced to 4¼ in. diameter for the remaining three floors.

Located 6 in. above each floor is a branch take off consisting of a malleable iron casting with a 3 in. flexible steel branch conduit supplying conditioned ventilation air to the room unit located under the window. This flexible metal branch connection provides for expansion and contraction during the heating and cooling seasons and serves as a simple means of taking care of irregularities in building construction. It also makes it possible to place the branch connection close to the face of the wall or even to conceal it within the wall. During installation, portions of the conduit system were tested under 10 lb air pressure and no leaks were observed.

Room Units

Located in each bay is a Carrier Weathermaster. Each unit consists of the following: air valve and pressure reducer, sound absorbing plenum box, primary air nozzle, secondary air cooling coil, primary and secondary air mixing stack, water flow control valve, and external cabinet. With respect to the water flow control valve it should be pointed out that it has only been during the last few years that serious attention has been given by engineers to the use of circulating water systems in large buildings. Because of this condition the manufacturers of specialties have been slow to develop accessory equipment. Very little attention had been given to the design of the water flow valves and because of the importance of these items some entirely new valves for use in large buildings were developed. One device, the balancing cock, consists of a double lubricated plug cock with dial which may be adjusted to close off both the supply and return line in the event that it is necessary to disconnect or replace the unit without draining the rest of the system, and it may also be used for adjusting the water flow if the flow does not appear to be in accordance with the theoretical or calculated design requirements.

Each of the 225 Weathermaster units is equipped with a self-contained water flow control valve which is thermostatically operated. The bulb for this valve is located in the recirculated air stream and constantly serves to position the valve in accordance with the room temperature. There has been some reluctance to accept self-contained thermostatic valves on radiators and analysis will show that this reaction is at least partially based on poor operation resulting from radiation effect on the bulb whenever steam is in the radiator and upon a lack of gravity air circulation whenever the radiator is only partially filled with steam. This condition is completely overcome because there is a continuous stream of typical room air over the bulb at all times regardless of the temperature of the cooling or heating coil.

Located beneath an access door on each unit is an adjusting knob which may be used to vary the room temperature. Once this knob has been set, however, the valve will continue to provide for that room condition as long as the units are supplied with water of the proper temperature. In this connection it should be pointed out that the water temperature in winter is varied by an outside zone thermostat which serves to integrate the effect of sun, wind, and dry bulb temperature.

Architect for this project was Elliot Dunwoody, Macon; consulting engineers were Newcomb and Boyd, Atlanta.

Soap Factory Has Three Air Conditioned Floors

In last month's issue was described the high pressure steam line from Boston Edison's Edgar plant to the new Procter & Gamble soap factory on the other side of the river. Three floors of the larger, Finished Products building are air conditioned. There is a smaller process building in the rear of this. On the first, air conditioned floor, are an employees' hospital, conference room, writing and test rooms, service, supervisors, and men's and women's waiting rooms. The second floor contains the general offices and the office girls' rest room, while on the third air conditioned floor are located the cafeteria, kitchen, factory girls' rest room, and lavatories.

The air conditioning system is a two-in-one installation, with pneumatic controls. No. 1 delivers an air volume of 9255 cfm and No. 2 a total of 8360 cfm. Both supply 25% of outside and 75% re-circulated air which is filtered, washed and cooled in summer, and in winter heated by the low-pressure steam supply, reduced to 10 lb for this purpose, before being discharged into a duct system by two fans, one for each part of the system. Air is passed through one washer with a division panel, necessitated by the fact that the kitchen and cafeteria provide a continuous load, while some of the other rooms are only part time used. A 60-hp York compressor is used for cooling. Contract calls for 80F dry bulb and 50% relative humidity as inside conditions. Duct work for the air conditioning and other heating totaled 11,000 lb.

In addition to the air conditioning there is considerable heating equipment on the upper floors, in the toilets, stairs, halls and lavatories, supplied by the Edison low pressure steam. Included are forty American Radiator radiators and fifty-five Modine convectors for this purpose, some of the units also being in various offices. Further, there are forty-nine Modine unit heaters and eight horizontal type Carrier units with self-contained fans. During the construction period, last winter, the heating contractor erected a temporary boilerhouse and installed two new steel firebox boilers, burning buckwheat coal with forced draft blowers. These were to warm the building and dry it out, and for comfort of the many workmen. When Edison steam was turned on, the boilerhouse was torn down and the boilers disposed of. For the heating a total of 15,000 linear feet of pipe of all sizes was required.

Performance of Subbituminous Coal in a Typical Underfeed Domestic Stoker*

By V. F. PARRY† and R. D. DEGUR‡

APPROXIMATELY 7½ million tons of subbituminous coals are mined annually in Colorado, Wyoming, and Montana, of which 50% probably reaches domestic consumers. These coals are good domestic fuels, are considered to be smokeless in most furnaces, and have been used for many years in hand-fired domestic furnaces in which the practice is to employ large lumps for efficient combustion.

During recent years the increasing use of mechanical stokers for domestic heating has changed methods of preparation. Although large lump sizes are popular for hand-fired furnaces, many mines have had to install preparation equipment to supply small sizes for domestic stokers. At present the modified pea size (approximately ¾ in. by 1½ in.) is popular, but some domestic users want the cheaper 2½ in. slack which is sold in large quantities for industrial purposes.

In recent years attention has been given to new designs of retorts for non-caking coals, particularly for lignite or the subbituminous ranks. A popular idea has been the introduction of additional airports on the outside top of the tuyere head to provide more air on the outside at reduced velocity, thus decreasing emission of fly ash and consuming unburned carbon that spills over the edge of the retort. Some manufacturers have built special lignite rêtorts that have few airholes inside the retort and in which most of the air is furnished through outside tuyeres. Optimistic claims have been made by manufacturers of these retorts, but few published tests are available which show the superiority of one type of retort over another; however, all of the new designs may have desirable features.

Investigation

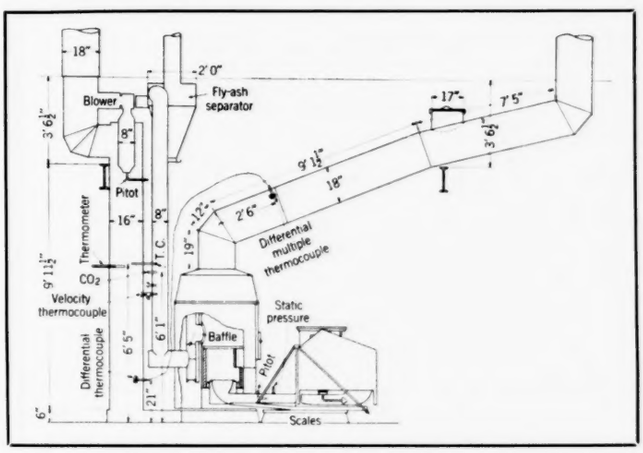
The object of the investigation, made during 1939-40 at Golden, was to make an experimental study of the utilization of subbituminous coal in domestic stokers to determine efficient methods of operation, the relationship of size and range in size of subbituminous coal to performance in household stokers, and the necessary changes in the design of retorts to permit improved combustion of subbituminous coals and lignite.

During a period of 140 days 15 tests were made on modified pea coal and 2½ in. slack under controlled conditions simulating those found in household heating plants. The two sizes of coal were burned at various rates, and the performance of the furnace was determined several times daily during an 8-day test. When the stock-model retort supplied with the stoker was used little difference could be detected in operation between the two sizes after the coal was in the hopper. The slack was dirtier and dustier than the modified pea coal, but both required about the same amount of attention for good operation of the furnace. Although slightly more power was necessary to burn the slack and the pressure in the retort was higher, yet it burned as well as the pea coal, probably owing to the crushing action of the worm, which fed both coals to the fire with substantially the same distribution of sizes. Further studies of this crushing action are planned.

Certain characteristics of the stoker and furnace were measured. These included variations in rate of coal feed, power consumption, attendance required, air pressure, indicated furnace efficiency, formation of fly ash, and distribution of ash. Contrary to expectations, more fly ash went out the stack when modified pea coal was used. The indicated furnace efficiency was 77% and no trouble was experienced in maintaining an average of 14% CO_2 in the stack gases at balanced conditions, which are reached about 6 minutes after the stoker begins to operate. For the first 6 minutes of operation the CO_2 measures from 2 5 to 14%.

The relatively high furnace efficiency in these tests probably is owing to the large combustion chamber, which insured complete combustion of the coal with an average of 30% excess air. The furnace had a combustion space of 6.8 cubic feet, and a hot-air radiator increased the heat transfer surface within the furnace to 44 sq ft. Although this furnace is small and is designed for an average house, apparently it is well designed for good operation with a mechanical stoker. Many homes in the Denver area are equipped with warm air furnaces having small combustion space and less heat transfer surface. These conditions may limit the efficiency of a stoker using subbituminous coal.

The first phase of the investigation—testing the performance of the stock-model retort—was completed. Tests will be made later on new retorts, on alterations in design of the worm, and on various intermediate sizes of subbituminous coal. The study was made by the Bureau of Mines cooperatively with Northern Colorado Coals, Inc.



Test unit for stoker study

*Reprinted from Bureau of Mines Report of Investigations 3557.

†Senior fuel technologist, Bureau of Mines, Golden, Colo.
‡Cooperative student, Colorado School of Mines, Golden, Colo.

ABSTRACTS of Current Papers, Books and Pamphlets

Insulation

How home owners of America would be able to save large sums and contribute materially to the National Defense effort is indicated in this report which deals with insulation of buildings.

The report points out that if buildings erected within the next ten years are properly insulated it is estimated that the home owners would save $125 millions in fuel costs annually and that this fuel could be diverted to defense needs and fuel carriers could be freed for defense work.

The report discusses the results of various tests both in the field and laboratory made by the Tennessee Valley Authority, the Bureau of Standards and various commercial concerns in which substantial savings in fuel bills were effected by proper insulation.

In addition to the discussion of possible savings and the value of insulation, the report describes how insulation works, discusses the laboratory and service tests, tells how to insulate, lists various advantages of insulation, and provides a description and tables of the miscellaneous products available for insulation.

The material in this report should be valuable to insulation companies and contractors in convincing the home owners of the desirability of insulating buildings.

[*"Home Insulation," by Paul M. Tyler. Information circular 7166. Published by the Bureau of Mines, Department of the Interior, Washington, D. C. Available free on request to the above bureau.*]

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Principles of Economical Heating

This booklet, which had its origin about 15 years ago, was originally compiled and written by engineers employed by the different utility member companies of the National District Heating Association for use by customers of district heating companies. The booklet has undergone several revisions and the most recent (1941) edition was submitted in final form before the recent convention of the National District Heating Association in Pittsburgh.

As stated in the introduction many of the principles set forth are applicable to heating systems regardless of the source of supply, some are possible only where district steam service is used, while others are more effective with district steam than with a private heating plant. While some of these features somewhat limit the scope of the book, nevertheless, since it was prepared by a committee of engineers of long experience in steam heating, it can safely be said that the book can be read and used with profit by anyone interested in steam heating.

The booklet describes the need for methods of controlling steam in the building heating system in order that the amount of heat supplied shall not exceed the amount actually required. Some of the more common faults of heating systems and their operation are pointed out and approved methods of manual and automatic control are described.

The following chapters are included: General Rules for Economical Heating Heat Losses from a Building; Determining the Quantity of Heat Required in Each Building; Temperature or Heat Control; Distribution in Steam Heating Systems; Methods of Heat Regulation in Steam Heating Systems; Temperature Control Equipment for Steam Heating Systems; Zone Heating; Additional Methods of Making Savings in Heating Systems; Common Faults in Heating Systems and Methods of Correction, and Domestic Hot Water.

The booklet was prepared by the Commercial Relations Committee of the National District Heating Association under the chairmanship of George H. Tuttle of The Detroit Edison Company, in collaboration with the National Association of Building Owners and Managers. At this writing the booklet is in mimeograph form but is expected to be available in printed form within the next four weeks. Further information available from John F. Collins, Jr., secretary of the National District Heating Association, 827 No. Euclid Ave., Pittsburgh, Pa.

[*"Principles of Economical Heating." Published by the National District Heating Association, Pittsburgh, Pa.*]

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Advertising and U.S. Government

How advertisers may properly use photographs and illustrations depicting military and naval equipment and personnel or copy which implies use of a product by soldiers and other references to the Army and Navy in advertising are discussed in this timely research bulletin issued by the National Better Business Bureau, Inc. Bulletin also reviews the regulations governing permissible references to Federal specifications, commercial standards and quality guaranteeing labels.

Other items discussed include the unauthorized use of the President's name, likeness or views; reference to furnishing or equipping Federal buildings or use of illustrations of Federal buildings in advertising; rules of the Department of Agriculture, Food and Drug Administration, Public Health Service and Bureau of Mines in regard to the various inspection, grading, certifying and licensing services which those government departments administer.

Emphasis is given to the importance of the rules and policies outlined by a review of a number of cases that have come before the Federal Trade Commission in which advertisers have been ordered or have agreed to cease using improper references to the various departments of the Government.

[*"What Every Advertiser Should Know Before Implying That the United States Government or Its Personnel Approves His Goods." Research Bulletin, published by the National Better Business Bureau, Inc., 405 Lexington Ave., New York. Paper cover; mimeographed; 8½ x 11 in.; 19 pages. Price, ten cents.*]

Industrial Hygiene

In order to conserve manpower in defense industries the U. S. Department of Labor has published this pamphlet entitled "Protecting Plant Manpower." The book presents practical information on such industrial hygiene subjects as fatigue; criteria of industrial health hazards; preventive measures; heating, ventilation, and cooling of work places; illumination, and noise. The book also outlines an industrial health program for smaller plants. It has been prepared by a group of outstanding authors and is designed to give available information on the control of industrial health hazards. Among the authors who have prepared the information for this pamphlet are Philip Drinker, Theodore Hatch, C. P. Yaglou, W. P. Yant, P. A. Neal, Dr. Leonard Greenburg, and J. S. Rogers.

[*"Protecting Plant Manpower." Special bulletin No. 3, U. S. Department of Labor, Division of Labor Standards, Washington, D. C. Paper cover; 6 x 9 in.; 70 pages. Available on request to the Division of Labor Standards.*]

BRIEF REVIEWS

Electric Rates. A book containing the residential, commercial and industrial electric rate schedules in both public and privately owned utilities in all communities of 1000 or more population and many other smaller communities in the United States. Book is in loose-leaf form to permit the addition of supplement and bulletin pages which are issued periodically to keep subscribers informed of rate changes and new rate schedules. Schedules are presented by utilities in each state in a standardized and uniform manner. A complete index showing the schedules available in each community is included. [*"National Electric Rate Book." Published by the Federal Power Commission, Washington, D. C. Contained in two flexible simulated leather binders; 9⅛ x 11⅜ in.; more than 1500 pages. Price, $10 including rate bulletins and periodic supplements for one year from date of subscription. Rate book for individual states available for $1 each including periodic supplements for one year. Address all orders to the Federal Power Commission, Washington, D. C.*]

Engineering Terms. A revised edition of the American Standard Abbreviation for scientific and engineering terms. Chief difference from the earlier edition is inclusion of abbreviation of terms not previously covered and the shortening of previously recommended abbreviations. For example, in the new standard lb per sq in, of the 1932 edition, has been shortened to psi (without a period). Other characteristics of the standard are elimination of spaces between word combinations or letters and the elimination of periods except in cases where the abbreviation spells out a common English word. [*"American Standard Abbreviation for Scientific and Engineering Terms, ASA Z10.1-1941." Published by the American Society of Mechanical Engineers, 29 West 39th St., New York, N. Y. Paper cover; 8½ x 11 in.; 7 pages. Price, 35 cents. Copies available from the American Standards Association, 29 West 39th St., New York, N. Y.*]

Anthracite Conference. A reprint of the papers presented before the Fourth Annual Anthracite Conference held at Lehigh University on May 8-9, 1941. Papers of interest to heating and ventilating engineers include the following: Heating for Pennsylvania Turnpike Buildings; Practical Pointers in Domestic Stoker Installations; Needed Trends in Boiler and Furnace Design; Anthracite Research at the Mellon Institute; Advanced Developments in the Control of the Combustion of Anthracite; Performance of Anthracite Fired Water Heaters; and Factors Affecting Thermal Comfort. [*"Transactions of the Fourth Annual Anthracite Conference of Lehigh University, Bethlehem, Pa." Paper cover; 6 x 9 in.; 237 pages. Available from Anthracite Industries, Inc., Chrysler Building, New York.*]

Air Filters. A report on the development of an instrument which is designed for continuous measurement of concentrations of smoke-like materials in filtered and unfiltered air. By determining density differences of impingement traces, it is possible to calculate percentage efficiencies of air filters. Apparatus consists of impingement recorder and photo-electric densitometer. The recorder operates continuously by impingement of air from a self-metering orifice on moving paper. The unit is portable. [*"Measuring Smokes and Rating Efficiencies of Industrial Air Filters," by A. C. Robertson, J. G. Mulder, and F. G. VanSaun. Published in Industrial and Engineering Chemistry, Room 706, Mills Building, Washington, D. C., May 15, 1941. Pages 331 to 334. Price, singles copies, 75 cents.*]

Air Conditioning. An elementary book on practical aspects of air conditioning. Author states that the book will serve to introduce beginners, and others with a slight knowledge of air conditioning, to other more advanced books. Book covers essential fundamentals, properties of air, human comfort requirements, equipment available, methods of operation and maintenance and servicing. A large amount of material in the book was originally used in lecture courses for dealers, salesmen, operators and servicemen. [*"Practical Air Conditioning," by A. J. Rummel and L. O. Vogelsang. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N. Y. Cloth bound; 6 x 9 in.; 282 pages. Price, $2.75.*]

Frozen Foods. A book based on a six-year investigation of the frozen food industry covering all phases of frozen food production and distribution from the grower to the consumer. Discusses markets, distribution policies, sources of supply, processing methods, and freezer-lockers. [*"The Frozen Food Industry," by Harry Carlton. Published by the University of Tennessee Press, Box 4013, Knoxville, Tenn. Cloth covered; 6 x 9 in.; 196 pages. Price, $2.00.*]

Arc Welding. A completely revised and re-edited edition of this well known book of lessons in arc welding. Includes 60 lessons which present the fundamental facts of welding. [*"Lessons in Arc Welding." Published by The Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. 6 x 9 in; semi-flexible simulated leather binding; 176 pages. Price, 50 cents per copy in the United States; 75 cents elsewhere.*]

NEWS OF THE MONTH

Improvements in Cooling Towers, Flour Mill Air Conditioning Reviewed in Papers at ASME Convention

KANSAS CITY—The 1941 semi-annual meeting of the American Society of Mechanical Engineers was held here June 16-19, at the Hotel Muehlebach.

Among the papers presented at the convention were "Air Conditioning in the Flour Mill," by George M. Sebree, president, Western Air Conditioning Corporation, Omaha; and "Cooling Tower Progress," by L. T. Mart, president, The Marley Company, Kansas City.

Mr. Mart, in reviewing the subject of cooling towers in a general way said that the rapid growth of air conditioning, principally, led water cooling manufacturers to design a new and better product. Most towers in air conditioning service are located on roofs in populous districts so that space is restricted, the weight must be limited and noise and drift of moisture are usually objectionable.

Mr. Mart said that, recognizing the short-comings, tower manufacturers began improving and simplifying their designs and that the advance in mechanical draft cooling tower design has been so marked that the type has developed wide popularity for nearly all classes of water cooling work.

The speaker included a table in his paper showing that not only have these improvements taken place but that the average cost over the period has gradually diminished.

In his paper on flour mill conditioning, Mr. Sebree said that the dollars-and-cents reason for air conditioning in a flour mill is the saving of shrinkage in mill stocks from needless evaporation. This saving may be as much as 1% of the entire output.

He said: "The best general-purpose flour has a moisture content between 13.5 and 14% by weight. The wheat will enter the mill at any moisture content from 16 down to 12 or even 10%. Deficiencies of moisture content in the wheat can be overcome to some extent by 'temperating' or mixing with water, before the wheat enters the first break roll. But from that point on, in the average unconditioned mill, the moisture content of the mill stock is strictly a matter of chance, depending on what the outside weather happens to be.

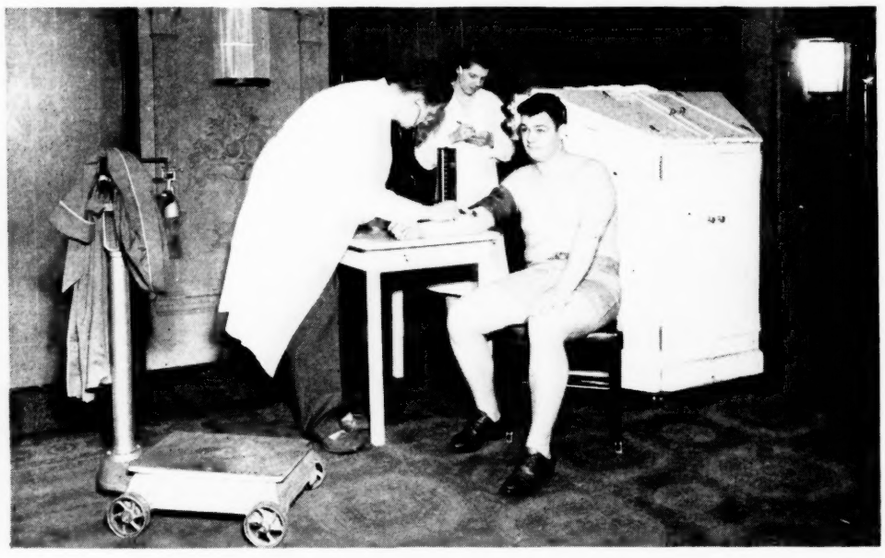
"There is a limit to the amount of moisture that can be added to the wheat by tempering. If too much water is used, the wheat will 'mush' on the rolls, and will go through the first sieves very slowly, if at all. There are no possibilities of adding water to the finished flour — the result would simply be dough. Storage of the finished flour in a room at high humidity does not offer much hope either. It would probably take weeks to raise moisture content of the flour uniformly, and few mills have space to store even their own production for more than a few days.

"The principal fact about air conditioning in a flour mill is that mill stocks, the products of the wheat berry in smaller and smaller particles as they pass through the rolls and sieves, tend to lose moisture if given any opportunity to do so. In an unconditioned mill the low relative humidities that usually prevail will evaporate moisture from the stocks at any and every point in the mill. The point of greatest moisture loss, however, is where the stocks are in contact with the hot rolls themselves. Considerable power is required to drive these rolls, and some of this power is converted into heat. The rolls get hot and stay hot.

"Evaporation could be stopped entirely, of course, if we maintained a high enough relative humidity in the mill. It would not be desirable to do this, however, principally because with present roller mill equipment there would be real trouble in holding roll temperatures down to even a reasonable point unless some evaporation were permitted. By taking into account the equilibrium relative humidities for various moisture contents of the finished products, and tempering the entering wheat to the proper point to permit the necessary amount of evaporation, the moisture content of the finished flour can be controlled with a great deal of exactness.

"Without reciting the entire table of equilibrium moisture contents for various relative humidities, it is sufficient to say that 60% relative humidity equals the desired final moisture content of 13.7%. The entering wheat is usually tempered to 15.7%, to allow for 2% evaporation. If the mill stocks were in contact with the air at 60% relative humidity long enough, the resulting flour would be at 13.7% no matter what the entering moisture content of the wheat. However, the stocks are in the mill only 20 to 30 min.; to make sure of positive results from the constant relative humidity in the mill, the wheat must be carefully tempered before it enters the mill.

"Closely connected with relative humidity, in flour mills as everywhere else, is temperature. The optimum temperature for flour milling would be 78F the year round. In summer this calls for cooling. In winter some heating may be required.



AIRTEMP DEMONSTRATES HUMAN BOILING POINT

The effect of high temperature and humidity on human efficiency was demonstrated to a large group of editors at the Chrysler Airtemp clinic on air conditioning, held in Dayton June 5. Business benefits and economic importance of modern air conditioning were stressed. A healthy young man stepped from the air-conditioned clinic room, where the humidity and temperature were just right for human effort both mental and physical, into a cabinet where humidity was raised to 65% and temperature to 124F in 20 minutes. Results: pulse went from 80 to 128; blood pressure from 155/88 to 172/84; respiration 18 to 24; body temperature from 98.8 to 100.4F. While test was admittedly extreme, it demonstrated in a short space of time the dangers of abnormal humidity and temperature, the slowing down of physical and mental reactions, and impressed the need for air conditioning wherever people work. Airtemp president D. W. Russell presided at the clinic, attended by a large number of business paper editors.

Suggests Cure for Post-War A.C. Slack

BUFFALO—Now is the time for the air conditioning industry to do a real promotion job, according to Walter P. Davis, executive secretary of the Air Conditioning Council of Western New York. In an interview during which he was asked questions on the outlook for air conditioning, Mr. Davis said power companies now are expanding their load facilities tremendously to take care of huge defense industry requirements. Defense plants are needing air conditioning now but after the war there probably will be a stalemate in most business lines and those industries which have done the best promotion job during the prosperity era will be in the strongest position when that stalemate comes.

Mr. Davis believes it behooves utility companies all over the country to start intensive promotional programs now to sell the public on the advantages and necessity of air conditioning and other power-consuming processes so that they will be in a buying mood when defense prosperity passes from the scene.

"I would like to see 150 air conditioning councils in all parts of the country, each doing its own particular job in its own community to build favorable public sentiment for air conditioning," Mr. Davis said. "These councils should stress the benefits of air conditioning and create a desire for it. Advertising programs should emphasize the satisfaction of those people who are using air conditioning."

Operating Engineers Urge Licensing

NEW YORK—Federal licensing of power engineers as a national safety measure was urged by delegates to the 46th annual convention of the New York State Association of Power Engineers, held here June 14.

Passage of a regulatory bill then before the Senate Committee on Military Affairs was advocated by the 181 delegates, representing some 2000 operating engineers in power plants, factories, office buildings, and institutions.

A federal board would be empowered under the proposed legislation to issue licenses to the engineers of stationary power plants whose output was utilized in interstate commerce or in national defense. Only citizens would be eligible for licenses, and the board would have authority to deny a license to any person suspected of disloyalty to the United States.

The measure was so drafted as not to conflict with licensing systems already effective in five states and many municipalities, including New York City. The engineers also went on record as advocating a New York State licensing system.

Stoker Makers Re-elect Hoke

CHICAGO—Stoker manufacturers gathered at White Sulphur Springs, W. Va., May 26-27 for the twenty-fourth annual meeting of the Stoker Manufacturers Association and pledged their full support to the nation's defense and emergency program. The manufacturers agreed to devote not only as much plant capacity, manpower, and material as possible for defense production, but to increase stoker production to almost any extent required.

Leaders in the stoker industry, meeting with representatives of allied industries and suppliers of raw materials used in stoker manufacturing, discussed the effect of priority, materials shortage, and the labor problem on stoker manufacturing and production in relation to the present sales and merchandising problems. "What's Ahead for Stokers?" was the convention theme at the two-days' session, with one of the features being a "Stoker Sales Information, Please." Six prominent sales managers comprised a board of experts and covered practically every phase of stoker sales problems in connection with new conditions being created as result of the national defense program.

Frank Hoke, Indianapolis, vice-president, Holcomb and Hoke Mfg. Co., was re-elected president. Also re-elected were B. O. Fink, Auburn, Ind., president, Auburn Foundry, Inc., as vice-president; and J. M. McClintock, Chicago, manager, stoker division, Illinois Iron & Bolt Co., as treasurer. Marc G. Bluth, Chicago, was re-appointed secretary.

Harrisburg Wants Smoke Relief

HARRISBURG, PA.—Mayor Howard E. Milliken will take up with the City Council, Public Utility Commissioner Richard J. Beamish's suggestion that Harrisburg take steps to rid itself of the black smoke which drifts over the city.

The Mayor added that he thought the matter was not under his jurisdiction, but rather lay with Public Safety Director William T. DeHart.

100 New A.C. Coaches for N.Y.C.

BUFFALO—One hundred air conditioned coaches have been delivered to the New York Central Railroad, Division Passenger Agent Carl A. Riebling reported here. This is the largest single unit in the Central's air conditioning program which will add 225 coaches to such cars already operating on through New York Central trains.

Delivery will start soon on 95 air conditioned coaches being manufactured for the Central by Pullman Company, the American Car & Foundry Company and Pressed Steel Car Company.

Pacific Engineers Attend Exposition

SAN FRANCISCO—A switch was pulled and with a few last throbs and pulsations, mechanical exhibits ended their short but vibrant life on June 20 when the Pacific Heating and Air Conditioning Exposition closed its doors on one of the most important and comprehensive expositions ever held in San Francisco. Californians and others from the 11 Western states were brought to a dazzling realization of what engineering and research has accomplished for human need and comfort.

Sponsored by the ASHVE, the exposition was acclaimed as a great contribution to public enlightenment of industrial foresight and progress. According to Charles F. Roth, exposition manager, displays of heating and air conditioning units and equipment became a magnetic attraction to many visitors planning the construction of homes, as well as engineers and operators.

The exposition proved an added attraction to members and guests of the ASHVE and the Heating, Piping and Air Conditioning Contractors National Association whose conventions were held here during the same period, June 16-20.

Products and equipment were displayed by many of the foremost manufacturers and designers in the country. Included among these exhibits were active displays of air conditioning equipment, boilers and furnaces, fans and blowers, control apparatus, registers and grilles, pumps, oil and gas burners, insulation material, piping, unit heaters, steam traps, steam specialties and radiators.

Judge Wants A.C. for Court

BALTIMORE—Air conditioning of court rooms as a means of maintaining morale and efficiency in hot weather is advocated by Chief Judge Samuel K. Dennis of the Supreme Bench of Baltimore City.

Asserting that the efficiency and morale of the Criminal Court here "is seriously curtailed and undermined" by the heat and "sweating, unwashed spectators," Judge Dennis appealed July 3 to the City Board of Estimates to have at least one of the court rooms air conditioned.

"It is virtually impossible for the court, counsel, jurors, witnesses and other officials to function in either of the Criminal Court rooms during hot weather as we now have, all made worse by the mass of sweating, unwashed spectators in attendance," he declared in a letter to the board.

"As the late Grover Cleveland said: 'We face a condition, not a theory'; a tough condition, too."

The jurist's request for relief through air conditioning was taken under consideration by the board.

Pittsburgh to Have Anti-Smoke Law

PITTSBURGH—After four months of comprehensive study, the Pittsburgh Smoke Commission presented a sweeping anti-smoke ordinance to Mayor Scully and the City Council here June 16 through Councilman A. L. Wolk, chairman of the commission and pioneer leader in the movement to clear the city's skies of heavy clouds of dirt and smog that black out the sun during the winter months and cost citizens of the city an estimated $15 million a year.

Based on the engineering fact that "to eliminate smoke, it must be attacked at its source," the proposed Pittsburgh plan is similar to the anti-smoke regulations adopted successfully in St. Louis.

The submitted plan would place control over railroads, industry and commercial buildings as well as homes. The commission pointed out, however, that at the same time it fully protects industry and coal mining interests.

Basic principle of the proposed regulatory measures is that all users of fuel must burn it smokelessly through use of mechanical devices or they must use smokeless, or processed coal.

One respect in which the Pittsburgh proposal as made is said to differ from measures of any other city is that it is adapted directly to the use of fuel produced in this district, and it provides that the law become effective progressively from Oct. 1, 1941, to Oct. 1, 1943.

Starting Oct. 1, 1941, all fuel users except railroads, river boats, private residences and stove heated apartments will be placed under the provisions of the ordinance.

April 1, 1942, is the expiration date of grace periods to be granted consumers who are unable to obtain the proper fuel-burning equipment.

On Oct. 1, 1942, railroads will be brought under provisions of the plan.

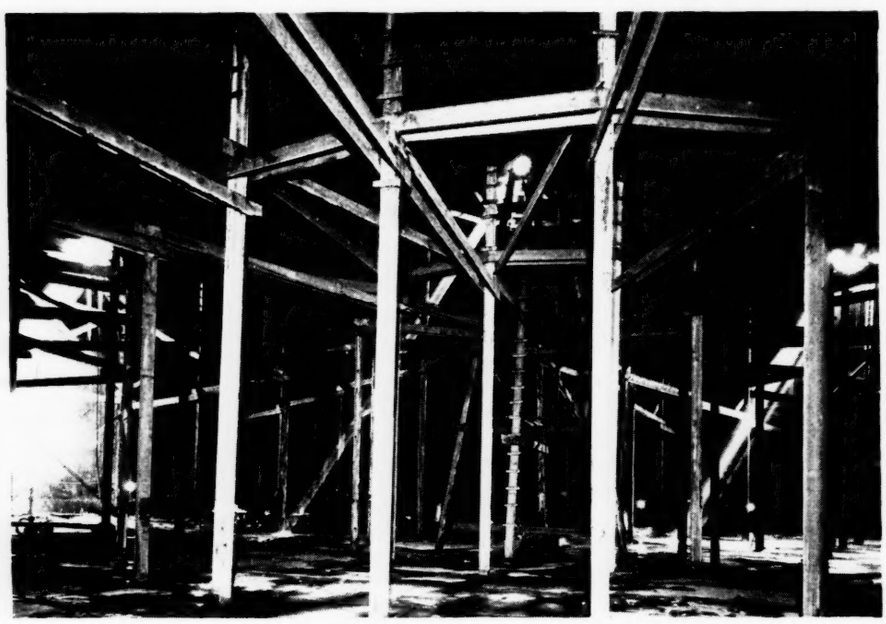
On Oct. 1, 1943, private homes, duplexes, stove-heated apartments and steamboats are to be included, and a provision that controls the amount of fly-ash emitted also is scheduled to become effective on this date.

AGA Schedules '41 Meeting

NEW YORK—The annual meeting of the American Gas Association will be held in Atlantic City, N. J., October 20-22. Because of the tremendous increase in activities incident to the national defense program and other exigencies affecting the gas situation, the program will be brief, pertinent and inspiring. No entertainment will be provided, as this will be strictly a business gathering, although there will be subscription luncheons and dinners.

McAward Secretary of NACA

NEW YORK—Arthur F. Callahan has resigned as secretary of the National Air Conditioning Association on account of ill health. The executive committee of the Association has appointed James C. McAward as secretary, with offices at 220 East 42nd St., New York.



THE RARELY SEEN INTERIOR OF A GAS HOLDER

Inside the 5,000,000 cu ft, 200-ft diameter, No. 1 holder at the Wythe Avenue Station of the Brooklyn Union Gas Company shown here being cleaned and overhauled. Timbers which support the crown when the holder is landed and which have been under water ever since the holder was built 39 years ago are still in good condition. The interior was so dark that the photographer had to use the fastest film, fire flash bulbs at a dozen different positions, and expose for seven minutes.

Los Angeles to Have A.C. Standards

LOS ANGELES—New officers of the local chapter of the ASHVE were installed June 13. Arthur J. Hess was installed as president; H. H. Bullock, vice-president; Leo Hungerford, secretary; and W. C. Stewart, treasurer.

President Hess appointed a special committee on standards which will direct the making of a study of standards of air conditioning in the Los Angeles metropolitan area. The committee will make a complete study of systems most suitable for the mild climate of Southern California; system capacity in relation to size of building; and types best suitable to buildings to be conditioned. The data assembled during the survey will be correlated into a standard, which, it is hoped, will eliminate much of the confusion and difference of opinion that now prevails regarding air conditioning requirements.

The standards committtee consists of Arthur Theobold, Robert Storms, Bucky Harris and Henry Sachs.

Ventilation Asked for Jail

BUFFALO—Lack of proper ventilation in the laundry and bakery at the Erie County Penitentiary at Wende makes conditions during hot weather "practically unbearable," it was reported by the State Commission of Correction following an inspection.

"In the laundry," the report stated, "inmates strip down to a minimum of clothing on sultry days when the room is so thick with condensed moisture that visibility is seriously affected. The gases from the bakery rise to the ceiling and it is impossible to keep the ceiling cleanly painted. Examination of the ventilation system disclosed that there was practically no draft whatever.

"Immediate steps should be taken to provide adequate mechanical ventilation in the laundry and bakery."

A.C. Bureau Hears Civilian Defense Talks

BOSTON—A special meeting of the Air Conditioning Bureau was held June 23, in co-operation with the Boston Committee on Public Safety in the Civilian Defense program. General theme of the meeting was "Air Conditioning's Part in the Civilian Defense Program of Boston." Fire Commissioner William Arthur Reilly, chairman of the general Boston Committee, City Building Commissioner James H. Mooney, John T. Ward, assistant vice president of Boston Edison Company, Chester Lindsay Churchill, architect, director Planning & Technical Division, Massachusetts Committee on Public Safety, and Mrs. Humphrey Plowden of Oxford, England, were the speakers.

Konzo Suggests Simplifying Boots

URBANA, ILL.—Manufacturers, jobbers, and dealers of gravity warm air furnaces can do their part to assist the nation's rearmament program by reducing the complexity of warm air heating plant parts through standardization, and by standardizing the rating of equipment and details of installation, according to a suggestion by Prof. Seichi Konzo of the University of Illinois Engineering Experiment station.

He points out that every pound of material not used to best advantage is a waste of resources in the nation's economy, and that tests carried on for more than two decades at the university give ample basis for the standardizing procedure. The possibilities are pointed out in a report he has made to the National Warm Air Heating and Air Conditioning Association.

For example, Professor Konzo says, seven different styles of "boots" are being made to join the stacks or warm air pipes with the collar openings on the top of a furnace. To join just one size of stack to the four standard collar openings, 28 different boots now are made. Four would be sufficient to do the job, and University of Illinois research provides ample data for selection of the proper style.

"Such a reduction will result in a smaller investment in dies, reduce storage space and stock investment, make for quicker delivery, and for general savings," the University of Illinois research engineer points out.

FHA Program to Continue

WASHINGTON — Continuation of all phases of the present FHA program under Title I and II of the National Housing Act is assured by President Roosevelt's signature June 28 of amendments to those titles.

Under the amendments, the authority of the FHA to insure property improvement loans and certain new construction loans under Title I is extended for two years to July 1, 1943. The maximum outstanding insurance liability under Title I is increased from $100,000,000 to $165,000,000.

The maximum amount of Title I loans for modernization of residential structures for two or more families is raised from $2,500 to $5,000, with the maximum term for loans above $2,500 extended from the former three years to five years. The maximum amount of a Title I Class 3 loan for construction of a new dwelling is raised from $2,500 to $3,000.

The President is authorized to increase the maximum principal amount of all mortgages insured under Title II which may be outstanding at any one time from the present $4,000,000,000 to $5,000,000,000.

Bus A.C. Discussed by Doyle

LOS ANGELES—Air-conditioning of railroad passenger cars, with emphasis on an internal combustion engine-drive unit and its development within the past two years into a compact unit of special design for air-conditioning buses, was treated at length in a paper presented at the June 4 meeting of Los Angeles chapter of the N.A.P.R.E. by F. W. Doyle, air-conditioning engineer, Waukesha Motor Co.

The bus unit, according to Mr. Doyle, is an adaptation of an internal combustion engine drive unit designed for railroad-car air-conditioning. It consists, he explained, of an automatic gas engine operating a compressor, the engine and compressor being mounted as one unit in a structural steel frame secured to the underside of the railroad coach or bus. The unit, Mr. Doyle explained, is mounted on cushion wheels with the entire mechanism supported on steel tracks which permit the unit to be rolled out for convenient inspection and maintenance. The fuel, Doyle said, is propane, which—for railroad cars—is carried in three 100 pound containers mounted under the car, and—for buses—in smaller containers below the chassis.

79 A.C. Systems for Chicago

CHICAGO—According to the Air Conditioning Division of Commonwealth Edison Company, 79 central air conditioning plants were sold in this city during May, 1941. These plants total 980½ tons capacity.

In addition, 218-room cooler installations, totaling 255 units, were sold during May.

Valve Charm Offered to Readers

NEW YORK—Jenkins Bros. is making a free offer to readers of HEATING AND VENTILATING consisting of a valve charm for a watch chain. To receive one of these valves send your name and address on a post card to Dept. QJ, 80 White St., New York.

Frederick W. Herendeen

GENEVA, N. Y.—Frederick W. Herendeen, 72, former president of the U. S. Radiator Corporation and formerly secretary of the National Boiler & Radiator Manufacturers' Association, died at Clifton Spring Sanitarium here. He was a member of the ASHVE and the AGA. He is survived by his widow.

NEW STOVE FOR ARMY TENTS

A new stove, that is collapsible and in which either wood or coal can be used, which will replace the conical-shaped Sibley Tent stove which was used in the World War.

"Is There a Bug in the House?" was the subject of the talk by T. O. McQuiston, sales promotional director of Allegheny County Steam Heating Co., through whose courtesy the photographs on these pages are presented.

A partial view of the exhibit space devoted to manufacturers booths.

Dr. F. C. Houghten, director of ASHVE laboratory, who spoke on "Research Trends in Heating."

(Above) T. Napier Adlam, Sarco Co., Inc., author of a paper on "Radiant or Panel Heating." (Below) NDHA President L. S. Phillips of New York Steam Corp.

Intermittent Heating, Panel Heating, Steam Jets Discussed at 32nd Meeting of District Heating Group

PITTSBURGH—Engineers and others associated with steam and hot water heating utilities, together with a number of engineers in-charge of heating plants at various institutions throughout the country, met here June 10-12 for the 32nd Annual Meeting of the National District Heating Association.

In addition to reports of committees on sales development, distribution, meters, steam station engineering, and rates and regulations, reports were presented by a number of committees whose work is of interest to the heating industry. These include the activities of the Commercial Relations and Research Committees whose reports featured a paper by F. W. Hutchinson, instructor at the University of California, on "Graphic Analysis of Intermittent Heating"; "Research Trends in Heating," by Dr. F. C. Houghten, director of the ASHVE research laboratories; a report on the re-editing of the Association's book, "Principles of Economical Heating"; a paper on "Radiant or Panel Heating," by T. Napier Adlam, Sarco Company, Inc., and others.

V. B. Ingram, New York Steam Corporation, as part of the report of the Commercial Relations Committee, presented a paper analyzing the results of zoning of 24 buildings of various types. The analysis indicated for 20 of the buildings a reduction of 10% in steam used after zoning. These 20 buildings used a total of 27,344 lb of steam per degree day before zoning and 24,600 lb per degree day after zoning. The reduction of 10% in steam use was obtained by a total investment for the 20 buildings of $13,903. The other four buildings showed an increase in cost after zoning, averaging 2%.

Consideration was given by the Research Committee to the idea of using a base other than 65F for computing degree days for various types of buildings. The Commercial Relations Committee in 1932 reported that for 175 buildings of all types the base temperature was somewhat other than 65F depending on the building type. For example, the base temperature for stores was 64F; for hotels, 66.5F; for auto sales and service buildings, 61.2F, for theaters, 67.6F, and so on. Consequently, the question has been raised as to whether it would be better to use a different base for different types of buildings rather than the arbitrary base of 65F.

Reporting on this subject, S. S. Sanford, of The Detroit Edison Company, concluded that a departure from the 65F base is justified in some cases such as garages where 55F is used by one member company. In general, however, Mr. Sanford stated that it appears that the 65F base is sufficiently accurate and that use of various other bases would cause confusion and make comparisons difficult.

R. Y. Sigworth, supervisor of utilities, The Pennsylvania State College, presented a paper on "Maintenance of Thermostatic Traps on Radiators and Risers" in which he tabulated the results for the season of 1940-41 on traps at his institution. His records showed that approximately 3300 radiator traps were in use on the campus during 1940-41. This does not include 11 new buildings that were put in operation during 1940. One hundred and eighty-five of these 3300 traps, or 5.6%, were replaced during this year. For the two-year period a total of 280, or 4.5%, traps were repaired. Mr. Sigworth reported that this seemed to be a true indication of replacement for his institution's plant operating condition. The cost of repairing the 185 traps during the season was $425.14.

In a similar paper G. K. Saurwein discussed "Maintenance of Thermostatic Radiator Traps at Harvard University" where about 9000 traps are in

One of the committee meetings. Facing the camera on the far side of the table are Glen D. Winans, W. A. Herr, D. L. McNulty, J. F. Malone, W. W. Stevenson, J. F. Collins, Jr.; President Phillips at the head of the table; E. E. Dubry, third from the right in foreground.

use. He stated that: "The traps bought since 1930 were purchased with a five-year guarantee, and have given good service. The earliest trap purchases were made in 1913-14, when a total of 1565 traps were installed in three dormitories—Smith, Standish, and Gore Halls. In 1930-31 many of the traps in these three buildings were out of order, and new inserts were installed in all of them, at a cost of $2348 for parts and $1170 for labor, or $2.25 per trap.

"Since that time only about 15 of these replacement elements have required renewal.

"The same satisfactory service has been obtained with the later traps, most of which were installed since 1930. It is believed that a contributing factor to this success was the installation in 1930-33 of automatic controls and the reduction of operating pressures from 5-7 lb to less than 2 lb and in some cases to less than 1 lb."

L. S. Stinson of the heat transfer department, Elliott Company, presented a brief paper on "25F Brine From a Steam Jet Cooling Unit." Mr. Stinson's paper follows:

"Early in 1937 a food products company purchased an Elliott 26-ton steam jet vacuum cooling unit designed to produce 35F chilled water, which was to be pumped through the water jackets of glass-lined vessels in order to cool a liquid in these vessels.

"After the unit was installed, it was found that a lower temperature cooling medium would give better results, possibly because the greater temperature differential increased the heat transfer rate through the glass lining of the vessels. Accordingly, brine was substituted for water as the cooling medium and the refrigeration load was reduced until 25F chilled brine was being produced. This gave very satisfactory results in cooling the liquid in the vessels.

"The following year it was necessary to make a considerable increase in production of the product using the cooled liquid and a second steam jet vacuum refrigeration unit was purchased. This second unit was designed for 40 tons of refrigeration when producing 25F chilled brine. In order to give the flexibility required for efficient process operation, it had one booster of 10-ton capacity and a second booster of 30-ton capacity with both boosters arranged for independent manual operation.

"As a result of a further appreciable increase in business, an additional necessary increase in production was made possible by the purchase, in the latter part of 1939, of a second 40-ton unit to produce 25F chilled brine.

"An interesting feature of both 40-ton units is that they are designed for throttling operation of the booster stages. Condensing water for these units is taken from Lake Huron, but there is a sand bar extending about a half mile out into the lake, so that the water is quite shallow near shore where the intake for the condensing water is located. As a result there is an extremely wide seasonal variation in the temperature of the condensing water. During the summer the condensing water is sometimes at a temperature of 80F or 82F and occasionally as high as 85F, while in winter, water temperatures may run as low as 33F or 34F for several weeks at a time.

"These units have booster condensers and two-stage ejectors designed to produce higher condenser vacuum when the condensing water temperature is lower than 85F. Thus it is possible to produce full refrigeration capacity and at the same time take advantage of the colder condensing water available during the winter months by reducing the steam pressure to the booster stages, which reduces the booster steam consumption in direct proportion to the decrease in the absolute steam pressure. For example, with the condensing water at 85F the booster stages are supplied with steam at 125-lb gage steam pressure but when very cold condensing water is available the steam pressure is throttled to as low as 25 lb reducing the booster

F. W. Hutchinson of the University of California whose topic was "Graphic Analysis of Intermittent Heating."

J. F. Collins, Jr., Secretary-Treasurer of NDHA, presenting his annual report

(Above) R. D. Martin, New York Steam Corp., chairman of the Sales Development Committee. (Below) P. C. Hodill, president of the National Association of Building Owners and Managers, who spoke on "The District Heating Customer's Viewpoint."

steam consumption to 28.6% of that required with 85F condensing water. A curve based on factory tests on the booster stages and showing the booster steam pressure required for various temperatures of the tail-pipe water from the booster barometric condenser is framed and mounted close to the operating valves for the operator's convenience in throttling operation.

A paper on "Absorption Refrigeration Operating Economies," by W. F. Friend of Ebasco Services, Inc., was not presented due to the absence of Mr. Friend but will appear in the Transactions of the Association.

In a very able summary of the subject, T. Napier Adlam, chief engineer, Sarco Company, Inc., described the origin, development, principles and applications of radiant heating in which he referred to, and showed slides of, installations made both in England and in the United States. In this connection he showed two methods of control as connected to various radiant heating systems, the method of operation being the same in each case. These are shown in the accompanying illustrations, where Fig. 1 illustrates the control applied to pipe coils imbedded in the floors with the outside thermostat on the outside wall of the building so that it can respond to the dual effect of air temperature and radiation losses. The radiant heat ball type room thermostat is shown in a key room to control the auxiliary bulb of the thermostatic system according to the room conditions. Fig. 2 illustrates the same control as connected to a radiant system using Rayrads or fabricated metal panels.

Peter B. Gordon, treasurer, Wolff & Munier, Inc., supplemented Mr. Adlam's paper with a brief report on "Panel Heating in the United States" in which he described the Crittall system for which his company is the American licensee.

Richard E. Hull, assistant superintendent, customer service department, New York Steam Corporation, presented in his paper his company's experience with steam jet air conditioning units during the season of 1940. In two of the three cases described by Mr. Hull the part of the machine on which there was trouble had not been maintained properly for a period of years. The author's experience indicated that a steam jet unit can be run with little maintenance without seriously affecting the operation of the machine.

As part of the report of the Steam Station Engineering Committee, A. A. Cummins and H. N. Barnard, consulting engineers, Ann Arbor, Mich., presented a paper on "Some Problems of Steam Generation and Use in Institutional Building Groups and Small Industrial Concerns." In this paper the authors said:

"The types of plant being discussed are more or less regarded as 'necessary evils.' In general they operate upon a close budget and any important repairs or changes become possible only *after* special appropriations have been made. Those in direct charge of such plants have difficulty due to technological features to explain the need of changes and improvements in a manner which will convince executives with little or no engineering background. Thus even though the plant operators know that undesirable conditions persist, they elect to overlook them rather than undergo the trials of attempting to explain them to a superior who more often than not is likely to be unsympathetic. This is especially true when maneuvering a special appropriation through the proper channels constitutes the first step in the solution of a problem.

"Most of the problems embarrassing such plants revolve around one or more of the following considerations.

"1. Total steam generating capacity when compared to the maximum steam requirement and not overlooking the outage of equipment from unpredictable causes beyond reasonable control.

"2. Fuel—its availability, storage, economical use, and ash disposal.

"3. Electric power generation as a by-product not overlooking capital, maintenance, and operating costs, as compared with the equivalent purchased power.

"4. The chemistry of water conditioning as it relates both to power plant use and corrosion in steam condensing equipment.

"5. Wasting of steam used for heating purposes.

"In the case of steam generating capacity, the accepted rule is that adequate capacity must always be available to satisfy essential steam requirements when one boiler is out of service. What constitutes essential requirements can be determined only by a study of local conditions. The maximum steam generating capacity of a boiler, however, should not be confused with its continuous generating capacity. Rarely can a unit be operated at a peak load for more than a short period—roughly four hours.

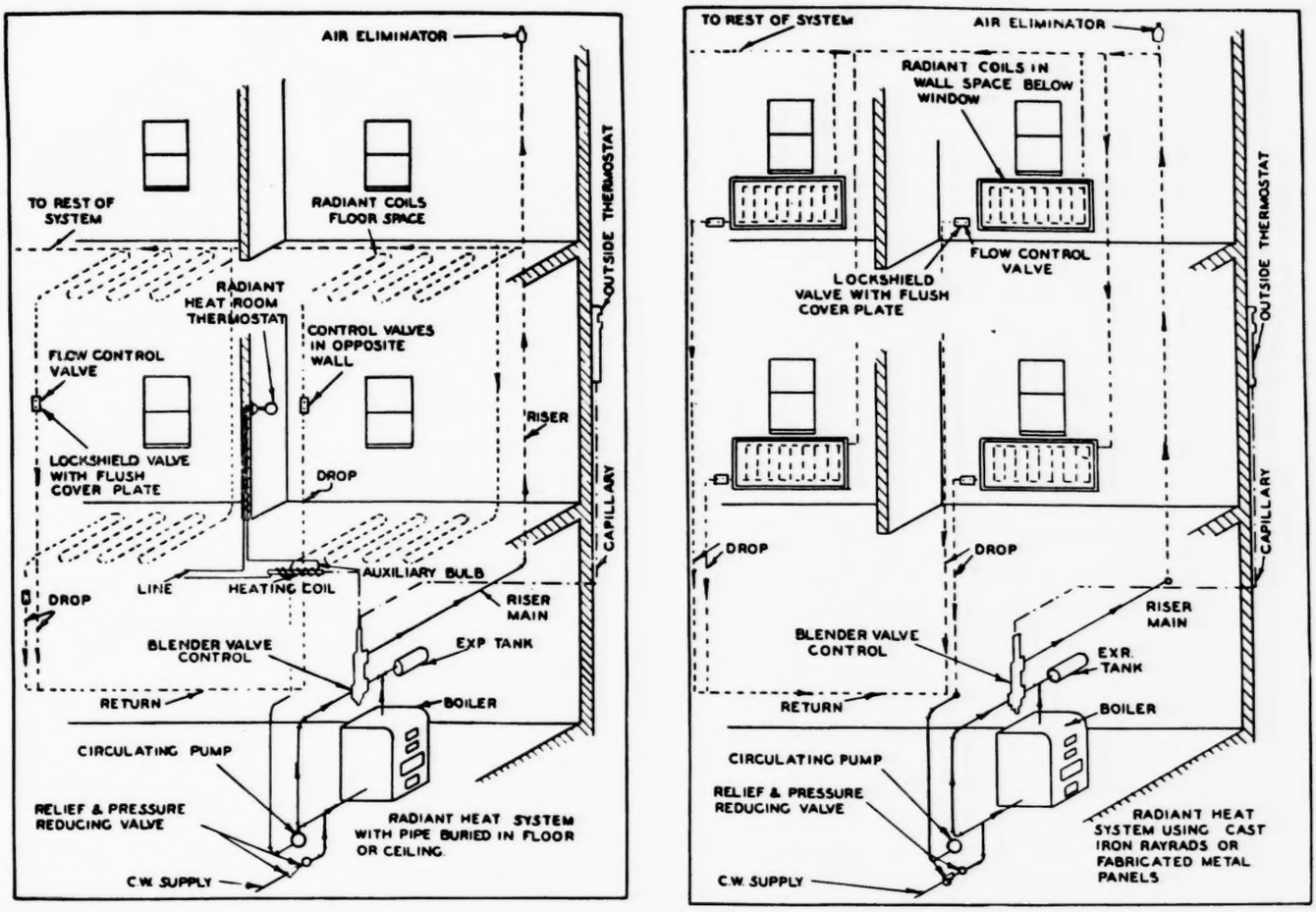
"Fuel handling and fuel economy present a perpetual problem in all plants. It is in this field, particularly in firing methods, that the most pronounced engineering advances have been made. It is in this field, also, that the most important savings can be made and that the urge to "over-engineer" is most pronounced.

"Among small plant operators there is considerable loose thinking relative to the economy of by-product power generation. While in many cases it may be a profitable procedure, considerable care is necessary in selecting the proper size and character of equipment. In the present paper electrical power generation is not discussed except where it influenced the selection of boilers and heating equipment.

"Water conditioning is probably the

A group examining the Pressure Jet in the booth of the J. E. Oliphant Co., Cleveland.

A. E. M. Schafer, Allentown, W. A. Schulmeister, American District Steam Co., and W. H. Boland, Hazelton, in the Adsco booth.



Control for two types of radiant heating systems, as described by Mr. Adlam in his paper. Fig. 1 (left) illustrates the control applied to pipe coils in the floor while Fig. 2 (right) illustrates the application of the control to a system using Rayrads or fabricated panels.

least understood feature in the operation of small stations. Although the difficulties in the use of boiler compounds, and the desirability of technical control have long since been demonstrated in large plants, it is generally true that the impression persists that "loose" methods still will suffice in the smaller plants. This is definitely an erroneous conclusion, nor need it persist. By the simple expedient of retaining a competent chemist upon a part time basis, equally as good conditions can be maintained in the small plant as in the larger ones. Paradoxical though it may seem, this procedure seldom entails any more expense than is entailed in paying the premiums usually included in the sale price of proprietary chemicals.

"The principles of economical heating have been excellently explained by the N.D.H.A. and other organizations. Many institutions and industrial concerns, however, fail to recognize the inherent possibilities of such savings.

"As a prelude to spending any important amount of money in any case it is of the utmost importance to evaluate carefully the remaining life of the equipment in question. Where only supplementary equipment is involved good engineering dictates that the savings so effected must amortize capital charges in a reasonable time.

"The remainder of this paper demonstrates how these generalisms were applied and the results that ensued when they were used in studying three typical cases."

Following this the authors gave data and descriptions of examples of the types of buildings referred to in their paper including those for a state hospital, a state normal college and one for a manufacturing concern. In conclusion they reported:

"It is well to investigate the boiler plant at intervals to find out what can be done under the then existing conditions to improve efficiency. These improvements may be any of the following:

"1. New fuel burning equipment.
"2. Added water walls.
"3. Added air cooled walls.
"4. Added economizers.
"5. Better feed water.
"6. Added instruments in order to better regulate performance.

"In making any improvements to old equipment careful consideration must be given to the probable remaining life of the existing boilers in order to assure sufficient length of life for the new equipment to justify its installation.

"If additional steaming capacity is required then the decision should be made between revamping existing equipment to get additional capacity and installing a new boiler. This is a separate problem for each plant and the decision will be influenced by age of existing equipment, cost of changes as compared to the cost of new boiler, savings to be made in each case, rate of increase in plant steam load and money available for investment.

"When space is available, the installation of a new boiler in an old plant, where the old boilers are becoming obsolete, presents the opportunity to begin a new complete set up which when it is eventually completed, will give a new installation, within the same space limits, of increased efficiency and greatly increased capacity.

"Careful checks show that heat control equipment can be installed in many buildings that will pay for itself in two years or less from the steam savings. These savings in most cases, we believe, will run 15 to 20% and in some cases where heating is being very badly handled, will run more. This possibility is probably well recognized by most of the district heating companies but it should be a very fruitful economy to many institutional groups and industrial plants.

"Where steam can be reduced from boiler pressure to heating header pressure by passing it through a turbine or engine, instead of a reducing valve, mechanical or electrical power can be secured for approximately one-half pound of coal per kwhr. If coal costs $5.00 per ton the fuel cost would be 1¼ mills per kwhr. There is, however,

the investment and operating cost of the engine or turbine to consider which may or may not make this practice a profitable procedure.

There are a wide variety of applications to secure this benefit and a careful analysis should be made in each case.

"Studies and observations point convincingly to the fact that a very large number of steam plants can cut fuel costs 15 to 30% by improvements in boiler room efficiency by controlling heating steam, and in some cases by generating by-product power."

F. W. Hutchinson, instructor at the University of California, presented a paper entitled "Graphical Analysis of Intermittent Heating," the intent of which was to establish a graphical solution of equations for determining the optimum start-up time for a given building using intermittent heating. As Mr. Hutchinson pointed out, the theory has been previously presented, but from a practical point of view the disadvantage of the theory is that laborious and time-consuming calculations are necessary to put the equations to use. Mr. Hutchinson's graph enables the user to find in a few minutes the time at which heating should be begun on a given structure in order to have the interior air temperature up to the desired point at a predetermined time.

Companies exhibiting at the manufacturers exhibit at the convention included Barber-Colman Company, Rockford, Ill.; J. E. Oliphant Co., Marion, Ohio; Sarco Company, Inc., New York; Spence Engineering Company, Walden, N. Y.; Central Station Steam Company, Detroit, Mich.; Marsh Tritrol Company, Chicago, Ill.; Union Asbestos & Rubber Company, Chicago, Ill.; Warren Webster & Company, Camden, N. J.; Ric-wiL Company, Cleveland, Ohio; E. B. Badger and Sons Company, Boston, Mass.; Strong, Carlisle & Hammond Company, Cleveland, Ohio; Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.; Wright Austin Company, Detroit, Mich.; American District Steam Company, North Tonawanda, N. Y.; and HEATING AND VENTILATING, New York, N. Y.

At the election of officers for 1941-42, Leonard S. Phillips, New York Steam Corporation, was reelected president and John F. Collins, Jr., Pittsburgh, was reelected secretary-treasurer. Other officers elected include Raymond M. Nee, Boston Edison Company, Boston, first vice president; John F. Malone, Consolidated Gas, Electric Light & Power Co., Baltimore, second vice president; and J. J. Schenk, Rochester Gas & Electric Corp., Rochester, third vice president. Members of the executive committee elected are Glen D. Winans, Detroit Edison Co.; John M. Arthur, Jr., Kansas City Power & Light Company; and Wm. A. Herr, Philadelphia Electric Company.

Defense Subject of New England Air Conditioning Conference; Hare, Huggins, Drinker, Cherne, Ingels, Brooks, Parker on Program

BOSTON—The importance of air conditioning in the National Defense Program was the subject of New England's Second Annual Air Conditioning Institute, sponsored by the Massachusetts chapters of leading national engineering societies, the Air Conditioning Bureau of Boston and the Air Conditioning Manufacturers Association. The Institute was held June 23-24 at the Massachusetts Institute of Technology and there were four sessions, mornings and afternoons.

At the first morning session, James A. Moyer, director of the Division of University Extension, Mass. Department of Education, was the chairman. The first speaker was H. V. Matzen, New York consulting engineer, on The Effects of Air Conditioning on Production. He was followed by Glidden L. Brooks, M.D. of the Harvard Medical School, speaking on Advances in Air Disinfection.

Dr. Brooks discussed briefly the standards for air conditioning recommended by the American Public Health Association and the spread of infection in general with special emphasis on the role of air-borne infection. He reviewed the means of air contamination with particular stress upon droplet nuclei as carriers of virulent organisms. He followed this by a few remarks on the methods of study of air-borne infection, including an appraisal of the normal variations in nasopharyngeal flora, devices for estimating bacteria in air, study of infections in hospitals, schools and other aggregations. He also gave a description of present day methods of controlling air-borne infection, with a keynote of caution against accepting such methods at their face value.

Following a recess, Miss Margaret Ingels, engineering editor of the Carrier Corporation, delivered a paper on Air Conditioning in Home Economics. Miss Ingels' address presented the woman's view on air conditioning.

Miss Ingels stated that an excellent index of the woman's attitude toward air conditioning is found in the experience of the average air conditioned beauty parlor. So favorable has been the acceptance of air conditioning in such shops that they no longer find it necessary to set up summer rates to keep their clientele from dropping off during the summer months.

Thayer Francis, formerly engineer with the Parks-Cramer Company now with a New Bedford concern, and an active member of the Air Conditioning Bureau, spoke on Industrial Air Conditioning, which he said dates well back into the eighties and was well entrenched in many industries before it caught the popular fancy a decade ago. From a process standpoint, he said, not all industries need air conditioning, but even the metal industry has found it of great advantage in special applications, such as in gear cutting.

Mr. Francis pointed out that it used to be said among air conditioning salesmen that there was no use in calling on a manufacturer of metal products. That has now been proved wrong and a great many metal products require air conditioning. For example, if the lacquering of metals is performed under muggy conditions, of too high humidity, a blushing with certain types of lacquer is a certainty and will require refinishing under more advantageous weather conditions.

He also stated that many other plants making products such as synthetic gut tennis racquet strings, certain types of addressing plates and the colored sheets used in theatrical spot lighting must have air conditioning.

E. Daniel Johnson, president of the Air Conditioning Bureau, presided at the first afternoon session, when A. L. Greenlaw of Tuttle & Bailey, Inc., New Britain, Conn., was the first speaker. Rather than giving a talk, Mr. Greenlaw showed motion pictures, with a few brief comments during the showing. The subjects covered were divided into two sections, on grilles and ceiling diffusers. Under the first category, the pictures showed the effects of temperature on the path of the air stream; of grille size, velocity, aspect ratio, and air spread on throw; the use of the spread type of grille to keep the cold air stream from dropping; and the use of upward deflection with cold air. In the second category he showed the performance of various types of Aerofuse outlets, the use of the velometer with ceiling diffusers, air distribution from Anemostats Type B and Type C, from a Venturi-flow, from the Agitair, the square Aerofuse, the use of cores to get uniform distribution with ceiling diffusers and the air path from sidewall Anemostats.

John P. Hare, engineer of the York Ice Machinery Company, gave an interesting and comprehensive paper on Centrifugal Compressors and Turbo-Hydro Compressors. Some abstracts of Mr. Hare's paper follow:

"A turbo-compressor is fundamentally a multi-stage fan, but differs from a conventional fan used to move air in that it raises the pressure of the delivered gas higher, must be gas tight, ruggedly constructed, closely fitted and capable of high rotating speeds. Turbo-compressors for Freon 11 are designed with two or three wheels, that is, two or three stages of compression with two most frequently used.

"The number of stages required is determined principally by the pressure differential from inlet to outlet against which the compressor operates. Most normal water cooling applications utilize two-stage compressors, whereas in-

dustrial processes requiring cold brine may utilize three stages of compression.

"It is to be noted that with an increase in pressure differential across the compressor there is a reduction in the volume of gas pumped. As the operating pressure increases and the volume of gas pumped decreases, a point is reached on the curve designated as pumping limit, beyond which unstable or erratic performance takes place. Conversely, as the pressure differential across the machine is reduced, the volume of gas pumped increases until a point is reached beyond which a given compressor will not perform at satisfactory efficiency.

"There are several methods of regulating the refrigerating capacity of centrifugal systems. Speed regulation is the preferred method, and the change of speed necessary for considerable variation of capacities is relatively small. This method of reduction assures minimum power consumption at reduced load. For compressors driven by steam turbines, the speed variation method of control is ideal. Where electric motor drive is used, it is necessary either to use a slip-ring motor with speed control or a constant speed motor with a hydraulic or electro-magnetic coupling for speed variation.

"The pre-rotation vane and suction damper method of control which throttles the flow of vapor from the water cooler to the compressor is used in conjunction with constant speed machines or to secure greater reductions than are possible with speed control alone. Power consumption, however, is higher than for the same amount of reduction by speed control.

"Condenser water control is also sometimes used. In this method the supply of condensing water is throttled to increase the condensing pressure, thereby reducing the gas pumping capacity of the system. This results in greater power consumption than either of the first two named methods."

Joseph F. Kern, Jr., associate editor of HEATING AND VENTILATING, was the first speaker on the second morning session. His subject was the heating and ventilating of military camps. Abstracts of his talk follow:

"In order to provide housing, military, health, and recreational facilities for the greatly enlarged army called for under the National Defense Program, the Quartermaster's Corps of the United States Army laid out a gigantic building program which made possible the rapid erection of temporary type, standardized structures. Complete plans and specifications were prepared for all types of structures needed. Structures were highly standardized and all buildings, except central heating plants have the same basic construction.

"The country was divided into three zones and three sizes of standardized heating plants were designed for each building.

"In order to select the proper size plant the contractor had only to determine which zone the building was located in and to use the standardized plan for that zone. Type of heating system depends on the type and size of building. Small buildings such as small mess halls and lavatories have cannon stoves. Barracks, administration offices, larger mess halls and similar buildings have forced hot air systems or unit heater steam systems, while all buildings in hospital groups and other buildings such as bakeries and reception centers have steam systems.

"Fuel is either coal or gas depending on the location of the camp and available fuel supply.

"Where a number of buildings are heated from a central boiler plant, steam is distributed at 100 lb pressure which is reduced to 40 lb per sq in. in each building where there are steam sterilizers and to 5 lb per sq in. for heating purposes."

H. E. Parker, mechanical engineer for the Fore River Works, Bethlehem Shipbuilding Co., Quincy, Mass., was the second speaker on the Tuesday morning session. He spoke on the heating and ventilating of ships and gave much valuable information on the type of systems used in merchant ships.

Dr. Philip Drinker of the Department of Industrial Hygiene of the Harvard School of Public Health then discussed the role of industrial hygiene in the Defense Program. He pointed out that while many advances have been made in improving working conditions there was still much to be done particularly in some of the munitions plants.

Since Dr. C. P. Yaglou, of the Department of Industrial Hygiene, Harvard School of Public Health, who was to speak on ventilating air raid shelters, was called away on Navy work, Amos Bartless of the B. F. Sturtevant Company spoke on the scheduled subject.

Realto E. Cherne, engineer of the Carrier Corporation, opened the afternoon session with a talk entitled The Economies of Air Conditioning. Abstracts follow:

"Effort is now being centered on the construction and operation of plants for production of defense materials. It is generally known that many of these plants are being completely air conditioned, manufacturing space as well as engineering and drafting departments and office space. Some plants require as much as 6,000 or 7,000 tons of refrigeration for air conditioning.

"Comprehensive data are not available on the relative overall costs of the windowless air conditioned buildings popularly called 'black-out' plants as compared with the more conventional now air conditioned type of building. One large firm of engineers and contractors has stated that the complete cost of the former runs 30% higher. If we consider this as a general statement, just what does the plant operator obtain for this increased cost? Important are: increased production due to the conservation of the workers' health and energy, uniformity of product and reduction of accidents due to fatigue (which comes quicker at high temperature).

"Since the cost of the air conditioning, refrigeration and auxiliary equipment is directly related to the amount of outdoor heat passing through walls and roof of the building, internal heat gain from people, machinery, process and lights, unit of capacity cost figures apply to defense plants pretty much the same as for other industrial applications, or even large sized comfort installations. One important difference in the economic situation is a possible emphasis on low first cost of defense plants at the expense of higher operating costs, due to the questionable useful life of the building. Another important consideration is the supply of materials of manufacture which may relegate overall economies to the background in favor of quicker delivery of equipment constructed of available materials and labor.

"Architects and engineers have asked why an array of unit costs could not be made available for simplifying preparation of budget estimates. The greatest problem is dissimilarity of construction, building occupancies and types of air conditioning systems."

Following Mr. Cherne's talk, F. O. Urban of the General Electric Company gave an analysis of sun load calculations in air conditioning. Few took notes on this, as Mr. Urban recommended to their attention wall temperature studies published in HEATING AND VENTILATING in 1940 and 1941 and to other published figures. His talk showed the significance of sun gains in the cooling load, and also the basic types of sun loads such as direct radiation through glass, and conduction through opaque materials.

L. Gale Huggins of the Westinghouse Company, Springfield, Mass., spoke on the future of air conditioning. He said that the perspective of air conditioning market had been raised very much for the manufacturer, engineer and contractor in the field, particularly the market for comfort air conditioning of industrial plants. He cited the fact that the average write-off of the cost of an air conditioning system in a defense plant within the government 5-year period, plus operating costs, brought a figure of seven to eight mills per man hour. He mentioned one aircraft plant that had one ton of refrigeration for every 450 sq ft of floor space, and another shell-making plant that had one ton for every 125 sq ft. This latter was because of the load from machinery and electric motors.

LETTERS TO THE EDITOR

Avery Comments on Radiant Heat

EDITOR, HEATING AND VENTILATING:

Is it permissible to raise a few questions of fact on some rather broad statements made by F. W. Hutchinson in his article "Radiant Heating in England" in your March issue? The article is so thorough in many ways that I hesitate to seem critical, and yet I just can't pass the whole without critical comment.

Is it not true that a great many monstrosities have been created in the past in the heating and ventilating business because of half-cockeyed thinking, to say nothing of engineering? Is it not equally true that we still see some terrible things done in the name of heating, ventilating or air conditioning?

It seems to me that radiant heating, panel warming, and panel cooling, may create more problems than they solve, if we skip lightly over our basic premises and build a structure on erroneous thinking.

Instead of accepting Mr. Hutchinson's statement "there is no such thing as radiant heat," I submit that there is no heat energy that did not start out as radiant energy. Mr. Hutchinson is trying to over-simplify a very complex relationship and, in so doing, lays traps for the unwary. Accept the dictionary definition that "Heat is a form of radiant energy," recognize that temperature is molecular motion, and at absolute zero all motion and all radiant energy (heat) cease. Then realize that every body above absolute zero temperature is radiating heat to any other body that is at a lower temperature level.

There is no such thing as convected heat! What does he mean by "convective"? What is the difference in this connection between our word "radiation," and Mr. Hutchinson's word "irradiation"? The subject is confusing enough without introducing new terminology. "Convected" heat may be "converted" radiant heat—is it?

Will a careful choice of wall colors "reduce the necessary energy input of panel heating system"? Why is not evaporation available to the engineer as a mechanism of comfort regulation? T_b (body surface temperature) does *not* remain constant, thank goodness!

The subject of radiant energy as affecting temperature, comfort, and health, cannot be dismissed as lightly as has been our wont. May I present this rather complicated—but very common—picture of the heating and ventilating engineer's problem when he undertakes to design a heating system.

The sun—incandescent at 6000C or about 10,590F—is sending radiant energy through the ether, stratosphere and atmosphere and comes in the glass window. That solar heat passed through upper air 100F below zero, and did not heat it! It passed through the earthy lower air, say at 40F, and did not heat it. It passed through the window but did not heat it—much. It did hit the outside wall, the window sill, the floor, the desk, or anything opaque, and gave up most of its radiant energy to that object. In this same room is a radiator at 212F, a room air temperature of 72F, and a ventilating system supplying air at 68F. Substitute, in the above, a panel heated ceiling for the radiator. What does this do to the cooling requirements of the incoming air? What about flexibility to adjust to sun load which any heating engineer will admit is the toughest problem we have to solve?

Panel heating can be a useful tool to work with. The present general unfamiliarity with radiant energy would indicate it may become a dangerous toy.

LESTER T. AVERY

CLEVELAND, OHIO

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The Author Replies

EDITOR, HEATING AND VENTILATING:

Mr. Avery raises three specific questions in connection with the nomenclature used in my article on "Radiant Heating in England." He urges acceptance of the "dictionary definition." With this suggestion I am in full accord though I am unable to find the dictionary in which appears the definition of heat which is quoted by Mr. Avery, "Heat is a form of *radiant* energy." Since Webster's New International Dictionary is a generally recognized authority I shall allow Mr. Webster to reply to Mr. Avery's objections:

I. Mr. Avery: "Instead of accepting Mr. Hutchinson's statement that, 'there is no such thing as radiant heat',... accept the dictionary definition ...

Mr. Webster: "Energy traveling in the form of radiation is sometimes called radiant heat. Radiation, however, is not heat but is the kinetic energy of vibration of the ether. It produces thermal effects when it meets bodies which absorb it..."

II. Mr. Avery: "What does he mean by 'convective'?"

Mr. Webster: Convective is "pertaining to, or of the nature of convection; caused or accomplished by convection."

III. Mr. Avery: "What is the difference in this connection between our word 'radiation,' and Mr. Hutchinson's word 'irradiation'? The subject is confusing enough without introducing new terminology."

Mr. Webster: To irradiate is "to throw rays of light upon, to shine upon."

(The word "irradiation" is a commonly accepted term—see Moon, "Scientific Basis of Illuminating Engineering"—used to designate the radiant energy falling upon a surface. Thus irradiation, unlike radiation, is independent of emissivity, reflectivity, etc.)

IV. Mr. Avery: "Why is not evaporation available to the engineer as a mechanism of comfort regulation? T_b (body surface temperature) does *not* remain constant, thank goodness!"

ASHVE Guide, 1941: "The body, under hot conditions, is in the zone of evaporative regulation, and for moderately extreme conditions a perfect balance between heat production and heat loss may be attained, *although at the cost of considerable discomfort.*' (Italics, Mine.)

As for the general statements which appear in the second, third and last paragraphs of Mr. Avery's comment I am indeed in substantial agreement.

F. W. HUTCHINSON

UNIVERSITY OF CALIFORNIA,
BERKELEY, CALIF.

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Radiant Heat with Warm Air

EDITOR, HEATING AND VENTILATING:

. . . We were interested in the [March] radiant heating section, despite the fact that you failed to include our many installations made since 1928. . . .

In these, the conditioned air for each room is admitted to the entire underfloor structure through small orifices in a dampered duct crossing under the joists at the inner wall, whence it moves very slowly (7 to 10 fpm) across to the outer wall, which is well insulated, up between the studs, and into the room through die-cut metal grille which is set into the face of, or behind, the continuous-slotted base.

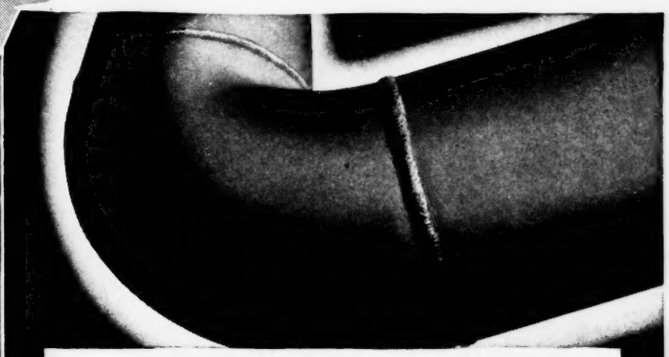
These are designed so the total heat entering under peak conditions of constant operation in below zero weather is not enough to raise the floor surface temperature higher than 90-95F. The additional heat required for comfort obviously enters in the conditioned air, and the moisture in this air, which is, of course, higher in content than that of the room so that it may supply the infiltering air's moisture deficiency, keeps the rough floor and the joists in perfect condition. One of these jobs has a 3-ton cooling unit and does an absolutely draftless job of cooling with all air returned from a single central hall

(Continued on page 78)

HOW TUBE-TURNS FILL 4 TIMELY PIPING NEEDS!

1 FAST INSTALLATION

Tube-Turns permit easier alignment and faster, better welding *thus speeding up today's production schedules.*

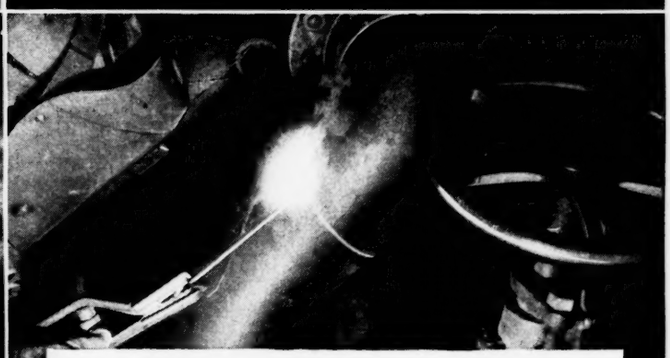


2 GREATER SAFETY

Tube-Turns' exclusive process and features, plus welding of joints, insure *greatest possible strength and safety.*

3 REQUIRE LESS SPACE

Tube-Turn elbows and returns save space, as they can be cut to any angle yet keep uniform wall thickness.

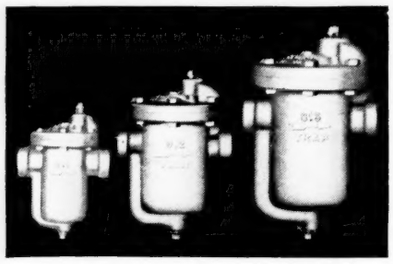


4 TROUBLE-FREE

Tube-Turn welded joints are *permanently leakproof,* and virtually *eliminate upkeep costs and delays.*

TUBE-TURNS, Inc., Louisville, Ky. • *Branches:* New York, Chicago, Philadelphia, Pittsburgh, Los Angeles • Distributors everywhere

NEW EQUIPMENT



Armstrong Side Inlet Traps.

Armstrong Steam Traps

NAME—Armstrong Side Inlet steam traps.

PURPOSE—For removing air and condensation from steam lines.

FEATURES—These three traps are new additions to the Armstrong line of Side Inlet Steam traps. All feature the basic body design which has been used by Armstrong for several years on the Side Inlet traps and the manufacturer claims the following advantages: (1) trap cap carrying mechanism can be removed without disturbing pipe connections; (2) leaving the trap body permanently in the line obviates the necessity of ever having to handle a vessel filled with hot condensate or having to reprime the trap; (3) installation convenience when it is practical to use horizontal straight-through pipe connections. All of these traps are built for operation on pressures up to 250 lb gauge. They are equipped with standard Armstrong all-stainless steel inverted bucket operating mechanism and are available with blast type Thermic air vent buckets and internal type check valves as optional equipment.

SIZES AND CAPACITIES—Three sizes. No. 811, 800 to 1000 lb per hr capacity range; No. 812, 1600 to 2000 lb per hr capacity; No. 813, 3000 to 4000 lb per hr capacity.

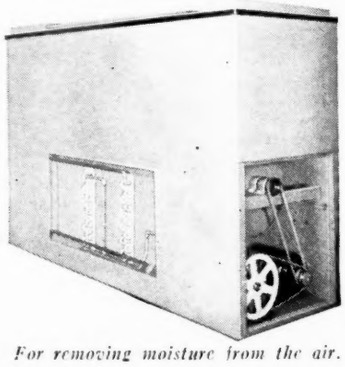
MADE BY—*Armstrong Machine Works, 8⅄6 Maple St., Three Rivers, Mich.*

General Air Conditioning Calorider

NAME—Calorider.

PURPOSE—For dehumidifying, filtering, and cooling air for summer operation and for humidifying air for winter use.

FEATURES—Unit uses both liquid and solid Caloride for dehumidifying air. In operation the air passes through a liquid Caloride spray and through water cooling coils which are kept wet with the Caloride solution. These coils serve to remove the latent heat which is released when the Caloride absorbs moisture from the air. After leaving this combined spray and cooling chamber the air passes through an eliminator and then through three beds of dry Caloride. These three beds serve to further remove moisture and any drops of Caloride solution from the air. The beds are separated by cooling coils which remove the latent heat which is released. As moisture is absorbed by the solid Caloride liquid Caloride is formed. This solution flows to a collection tank from which it is pumped to the spray chamber. Excess solution is discharged to the sewer. Storage bins which feed the solid Caloride automatically into the solid Caloride compartment hold approximately 2000 lb of Caloride. Manufacturer states that satisfactory results will be obtained with the Calorider when water having a temperature up to 75F is available. It is said that the Calorider will deliver up to 1500 cfm. It is encased in an all-metal cabinet



For removing moisture from the air.

54 in. high, 90 in. long and 30 in. wide. The unit can be used for humidifying in winter by passing hot water through the coils and using a plain water spray in the spray chamber. A close control is provided for additional make-up water. Company also manufactures two smaller models with capacities of 250 and 100 cfm respectively.

MADE BY—*The General Air Conditioning Corporation, Cincinnati, Ohio.*

Roxalin Sheet Metal Coating

NAME—Roxaprene.

PURPOSE—A corrosion resistant synthetic coating for sheet metal.

FEATURES—Manufacturer states that this synthetic material provides a substitute for zinc coating on sheet metal. It is said that Roxaprene applies like the paint finishes in general use (by spray, dip, or roller coat) requires no special treatment and it air dries quickly or may be forced dried in 50% of the time required by conventional synthetics. It is further stated that when immersed in 2% caustic solution unpainted hot dip galvanized steel shows corrosion in as short a time as 50 hours, whereas, Roxaprene is unaffected after 600 hours. Roxaprene showed signs of failure only after 96 hours in the same dilute hydrochloric acid solution that ate through galvanized coatings in 2½ hours.

MADE BY—*Roxalin Flexible Lacquer Co., Elizabeth, N. J.*

National Radiator Gas-Fired Boiler

NAME—National Radiator gas-fired boiler.

PURPOSE—For supplying steam or hot water using gas as a fuel.

FEATURES—This line of gas heating units is equipped with draft stabilizers concealed under the top of the boiler jacket. Additional features include National designed gas actuated fuel and boiler controls; tapered flue-ways with staggered ribs projected into the path of the gases; internal baffles pitched at an angle to increase water circulation; and anti-surge baffles in steam boilers to prevent priming and knock-out entrained moisture so as to supply dry steam.

MADE BY—*The National Radiator Company, 221 Central Ave., Johnstown, Pa.*

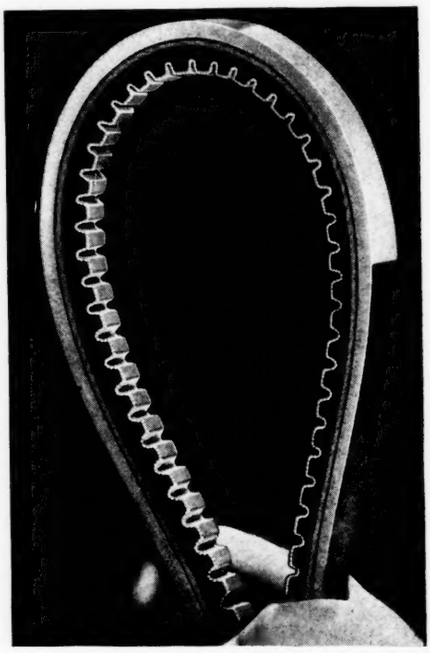
Dayton Belt

NAME—Dayton Cog-Belt.

PURPOSE—For use with either flat or V-grooved pulleys.

FEATURES—This belt is designed around a new type of cog construction principle on the inner surface of the belt. Manufacturer states that not only does this construction provide greater flexibility and longer belt life when flexing around small pulley diameters but for V-flat drives it applies the scientific principle of increasing traction by means of a non-skid design. Belt is being manufactured in all standard lengths in A, B, C, D, and E cross-sections and in matched sets for multiple drive service.

MADE BY—*Dayton Rubber Manufacturing Co., Dayton, Ohio.*



For use with either flat or V-grooved pulleys.

It's Not What You Pay NOW, but What You're GOING to Pay!

Barber-Colman Temperature Control Equipment is, of itself, only a means to an end. That end is to provide temperature control according to specifications FOR A LONG TIME TO COME, and with MINIMUM MAINTENANCE COSTS. Barber-Colman equipment may be more expensive, but it will prove cheaper and better in the long run. Fore-minded men know it is the Long Run that really counts. The old saw about the First Cost and the Upkeep is a warning to those who think only in the present.

BARBER-COLMAN
TEMPERATURE CONTROL SYSTEMS

The wide range and variety of types and sizes of equipment make it possible for B-C engineers to lay out an ELECTRICALLY-OPERATED Barber-Colman Control System for any type of heating, cooling, ventilating, or air conditioning installation. Descriptive literature, giving a comprehensive idea of the possibilities, will be furnished promptly on request.

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Send for this FREE BOOK on
AUER GRILLES

AUER makes a wide line of attractive grille designs in stamped metals for all purposes, from which heating contractors can make selections appropriate to any surroundings. Practically any desired sizes, materials or finishes can be promptly furnished to fit your requirements for air conditioning, ventilating, radiator enclosure, or concealment. For choice of design and determination of sizes on grilles, keep this new Auer Grille Catalog "G" handy. It gives complete grille data with actual size details. A copy will come to you on request. Complete Register Book 41 also sent if desired.

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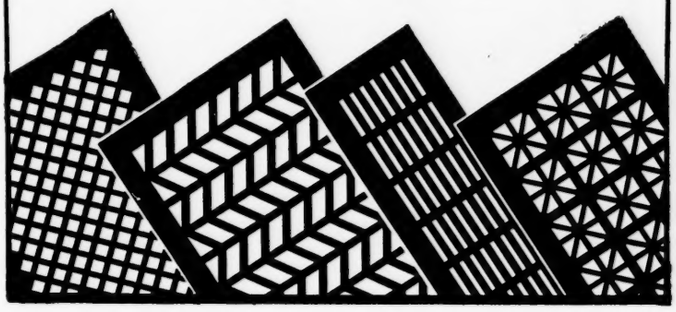
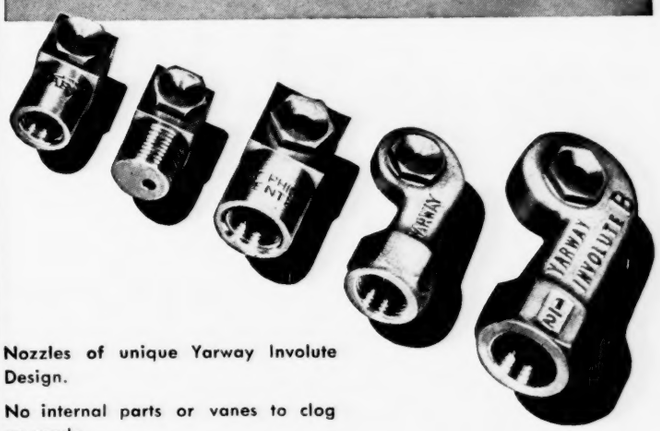


AIR CONDITIONING NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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104 MERMAID AVENUE
PHILADELPHIA

YARWAY

Beacon-Morris projector heater.

Beacon-Morris Unit Heaters

NAME—Beacon Projector unit heaters, series P-150.

PURPOSE—For supplying a downward flow of heated air.

FEATURES—Unit heaters are equipped with either standard type deflector cones to give an even heat distribution or an Anemostat deflector when better air distribution is required. The extended surface is guaranteed to withstand working pressures up to 150 lb per sq in. Copper pipe headers are 180° apart and are said to give ample steam delivery and rapid removal of condensate. The use of pressure type propellers is said to give high efficiencies.

SIZES AND CAPACITIES—13 sizes with capacities ranging from 21,300 to 400,000 Btu per hr.

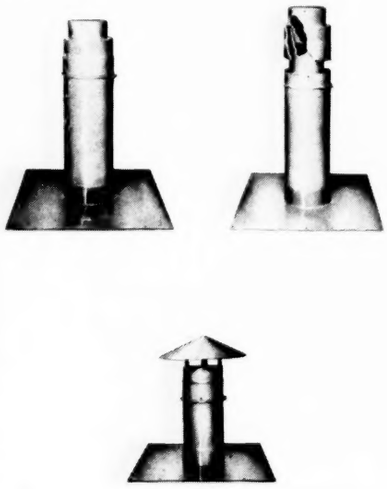
LITERATURE—Catalog 2004.

MADE BY—*Beacon-Morris Corporation, 702 Beacon St., Boston, Mass.*

Condensation Engineering Flue Pipe

NAME—Vitroliner vent pipe.

PURPOSE—An insulated porcelain flue pipe designed to eliminate the need for erecting masonry chimneys for residential and small commercial space and water heating installations.



Eliminates need for masonry chimneys.

FEATURES—This pipe is made up of sections of vitreous enameled pipe and fittings insulated with a high temperature, pre-fabricated asbestos wall 1 in. thick. The outer surface is coated with refractory cement while the insulation is held together with metal bands. Manufacturer states that it is required only where the pipe is to be used as a self-contained chimney or where sections of it are adjacent to combustible materials. It has the approval of the National Board of Fire Underwriters where gas is used as a fuel. Their only requirement is 1 in. clearance from combustible materials. Manufacturer claims that the use of this pipe will eliminate the erection and maintenance costs of chimneys and a large amount of floor space can be saved. Manufacturer claims that this porcelain enameled flue liner not only eliminates possible damage from flue gas condensation but also results in fuel saving.

SIZES—Pipe is made from Armco ingot iron in 6, 12 and 24 in. lengths with bell and spigot type joints. Diameters range from 3 to 10 in.

MADE BY—*Ingram-Richardson Manufacturing Company, Frankfort, Ind.*

DISTRIBUTED BY — *Condensation Engineering Corporation, Chicago, Ill.*

Perfex Thermo-Draulic Gas Valve.

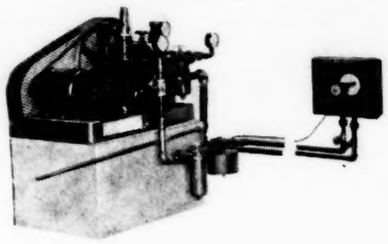
Perfex Gas Valve

NAME—Thermo-Draulic gas valve.

PURPOSE—For controlling the flow of gas to burners.

FEATURES—Unit is designed for use with a room thermostat or other devices. Valve disc is opened by expanding liquid in the thermo-draulic element. This liquid is heated by an external coil energized by the controlling instrument. In case of power failure, broken wire, or possible damage to the thermo-draulic element the valve will return to the closed position. It is said that no lubricating or periodic service is required other than cleaning. Models are designed for AC or DC power supply, for low or line voltage, with or without manual opening and automatic recycling feature.

MADE BY—*Perfex Corporation, 500 W. Oklahoma Ave., Milwaukee, Wis.*



For supplying a number of oil burning nozzles from one oil and air pump.

Leiman Oil Burning System

NAME—Leiman oil burning unit.

PURPOSE—An oil burning system which supplies air and oil to a number of burner nozzles at different locations.

FEATURES—This oil burning multiple unit is said to make possible the use of a single air and oil driven motor pump set for supplying air and oil to a number of oil burner nozzles. For instance, there may be one or more nozzles used for the heating boiler, another for the power boiler and several others at points throughout the plant for firing various industrial operations, all supplied with air and oil by one pump set. Pump sets and nozzles are said to efficiently handle any grade fuel oil.

MADE BY—*Leiman Bros., 117-8 Christie St., Newark, N. J.*

Thrush Water Circulator

NAME—No. 16 Junior circulator.

PURPOSE—For forced circulation in hot water systems.

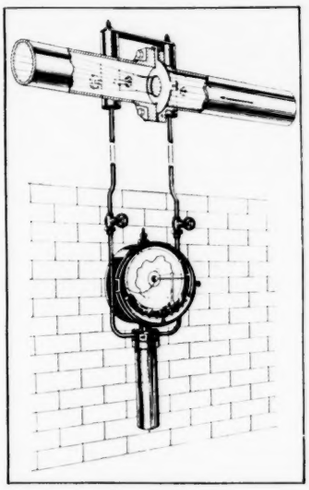
FEATURES—This circulator is said to represent a reduction of more than 20% from the present trade cost of circulators of comparable capacity and is rated for jobs up to 450 sq ft of installed radiation. Special feature of the circulator is that when it is used with systems not incorporating summer-winter provision for domestic hot water, gravity circulation through the circulator when not operating is equal to the volume of water that will flow through a 1 in. pipe. Circulator is equipped with a 1/20 hp motor.

MADE BY—*H. A. Thrush & Co., Peru, Indiana.*

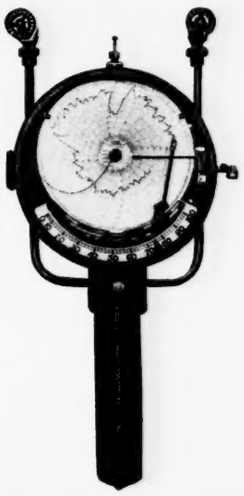
Low cost hot water circulator.

The ADSCO FLOW METER, Orifice Type

ACCURATELY METERS STEAM, WATER, COMPRESSED AIR OR GAS.
SIMPLE IN CONSTRUCTION - - EASILY INSTALLED



Free Floating, Frictionless Meter Mechanism transmits flow to direct-reading, evenly-divided chart



The ADSCO Flow Meter has a record of exceptional accuracy at all rates of flow. It is highly sensitive to fluctuations in flow but cannot be damaged by sudden overloads or reverse flows. Simple and rugged in construction—easily installed and maintained—requires no frequent inspection or adjustments.

Available with recording chart, indicating scale and integrator counter to totalize the flow or in other combinations of these three devices.

Correspondence is invited regarding your metering problems so that ADSCO may make recommendations based on over 25 years experience in the manufacture of meters.

Write for Bulletin No. 35-83V

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

VENTILATION OR HEAT *WHICHEVER YOU WANT*

Here's the low-cost way to provide VENTILATION during summer and ample HEAT all winter. Reznor Suspended Unit Heaters give both. They quietly distribute more air with greater velocity, and provide maintenance, labor, and fuel savings. Industrial and commercial jobs are easily figured and installed. Best of all, Reznor Units are FOOLPROOF and SAFE. Catalog U 41 shows specification and installation data. Write today.

REZNOR MANUFACTURING CO.
302 JAMES ST. MERCER, PENNA.

GAS FIRED

Three types, nine sizes, input ratings from 55,000 to 400,000 Btu.

REZNOR

"GAS HEATERS EXCLUSIVELY SINCE 1888"

FOR DRYING AIR or GASES

CALORIDE

WHAT "CALORIDE" IS—"Caloride" is an especially designed, patented form of moisture absorbing chemical produced in the shape of hard, fused solid blocks as shown above.

WHAT IT DOES—Upon exposure to air, "Caloride" cubes attract moisture, gradually diminishing in size as moisture is absorbed. Due to their patented features, "Caloride" cubes retain their form until they are entirely dissolved—thus permitting free and continuous circulation of moisture laden air or gas through a suitable container filled with cubes.

WHERE USED—"Caloride" is used wherever there is a need for control of excessive humidity. "Caloride" prevents condensation and ends mold, mildew and other damage caused by excessive moisture in air. Its use is not restricted to any particular size or type of equipment—it is being used in commercial units handling large volumes of air as well as in small equipment designed for more limited application.

SEND FOR DETAILS

SOLVAY SALES CORPORATION • 40 Rector Street, New York, N. Y.
Please send complete details on "Caloride"—including prices, packages, new folder "Caloride For Drying Air or Gases."

*Name*_____

*Affiliated with*_____

*Address*_____

*City*_____ *State*_____ 85-741

Number of Degree-Days for May, 1941

HEATING & VENTILATING continues its thirteenth year of publishing degree-day data for various large cities. Forty-four cities have been added to the list of those previously published. A total of 114 cities are listed below.

	Degree-Days May, 1940	Degree-Days May, 1941	Deg. Days Season, 1940-41
Albany, N. Y.	218	227	7098
Alpena, Mich.	...	298	7592
Atlanta, Ga.	58	25	3102
Atlantic City, N. J.	...	139	4925
Baker, Ore.	...	366	6119
Baltimore, Md.	95	61	4379
Binghamton, N. Y.	...	246	6771
Birmingham, Ala.	42	13	2635
Bismarck, N. D.	...	229	8207
Boise, Idaho	...	234	5271
Boston, Mass.	269	199	5993
Buffalo, N. Y.	370	324	6852
Burlington, Vt.	284	326	7987
Cairo, Ill.	...	26	3822
Canton, N. Y.	...	282	8198
Charles City, Iowa	...	120	7020
Charlotte, N. C.	...	33	3230
Chattanooga, Tenn.	...	35	3675
Cheyenne, Wyo.	344	336	6749
Chicago, Ill.	361	172	5955
Cincinnati, Ohio	203	94	4852
Cleveland, Ohio	303	177	5870
Columbia, Mo.	...	34	4615
Columbus, Ohio	224	120	5232
Concord, N. H.	...	322	7065
Concordia, Kan.	...	48	5213
Davenport, Iowa	...	75	5760
Dayton, Ohio	...	123	5330
Denver, Colo.	190	158	5380
Des Moines, Iowa	200	69	5840
Detroit, Mich.	301	176	6316
Dodge City, Kan.	86	53	4709
Dubuque, Iowa	...	97	6293
Duluth, Minn.	533	397	8609
Eastport, Me.	...	520	7870
Elkins, W. Va.	...	242	5796
El Paso, Tex.	5	15	2348
Erie, Pa.	293	212	6187
Escanaba, Mich.	...	331	7810
Evansville, Ind.	128	74	4552
Fort Smith, Ark.	...	0	3072
Fort Wayne, Ind.	275	169	5995
Fort Worth, Tex.	4	1	2398
Grand Rapids, Mich.	305	162	6301
Green Bay, Wis.	386	205	7353
Greensboro, N. C.	...	75	4062
Harrisburg, Pa.	143	110	5362
Hartford, Conn.	221	199	6320
Helena, Mont.	...	328	7214
Huron, S. D.	...	124	7247
Indianapolis, Ind.	216	106	5118
Ithaca, N. Y.	237	257	6792
Kansas City, Mo.	100	27	4657
Keokuk, Iowa	...	61	5229
Knoxville, Tenn.	88	46	3625
La Crosse, Wis.	252	110	6872
Lander, Wyo.	...	288	7649
Lansing, Mich.	327	205	6740
Lincoln, Neb.	156	53	5608
Little Rock, Ark.	31	0	2924
Los Angeles, Calif.	29	27	1035
Louisville, Ky.	159	68	4263
Lynchburg, Va.	...	72	4006
Madison, Wis.	331	145	6918
Marquette, Mich.	...	320	7625
Memphis, Tenn.	36	10	3005
Milwaukee, Wis.	396	236	6623
Minneapolis, Minn.	298	132	7454
Nantucket, Mass.	...	309	5775
Nashville, Tenn.	95	35	3548
New Haven, Conn.	213	166	5765
New Orleans, La.	0	0	1215
New York, N. Y.	179	121	5197
Norfolk, Va.	66	46	3507
Northfield, Vt.	...	388	8438
North Platte, Neb.	...	95	5836
Oklahoma City, Okla.	19	8	3487
Omaha, Neb.	161	60	5715
Oswego, N. Y.	...	321	7031
Parkersburg, W. Va.	...	132	4935
Peoria, Ill.	217	89	5612
Philadelphia, Pa.	122	79	4840
Pittsburgh, Pa.	182	146	5293
Pocatello, Idaho	...	292	6485
Portland, Me.	389	317	6630
Portland, Ore.	112	216	3410
Providence, R. I.	262	175	5815
Pueblo, Colo.	...	142	5362
Raleigh, N. C.	...	47	3448
Reading, Pa.	141	105	5323
Reno, Nev.	127	270	5027
Richmond, Va.	78	63	4053
Rochester, N. Y.	243	254	6981
Roseburg, Ore.	...	216	3499
St. Joseph, Mo.	...	34	4969
St. Louis, Mo.	111	29	4319
Salt Lake City, Utah	49	139	5034
Sandusky, Ohio	...	149	5903
San Francisco, Calif.	213	151	1927
Sault Ste. Marie, Mich.	...	374	8294
Scranton, Pa.	205	190	6318
Seattle, Wash.	147	240	3454
Spokane, Wash.	166	293	5467
Springfield, Ill.	158	47	4984
Springfield, Mo.	...	36	3748
Syracuse, N. Y.	237	263	7024
Tacoma, Wash.	...	276	3859
Terre Haute, Ind.	...	80	4930
Toledo, Ohio	281	141	6050
Trenton, N. J.	149	114	5302
Utica, N. Y.	224	258	7284
Washington, D. C.	95	89	4432
Wichita, Kan.	67	28	4532
Yakima, Wash.	...	219	4871

(...)Indicates data not available.

YARWAY GUN-PAKT EXPANSION JOINT

It is packed under full steam pressure. By the turn of a wrench, integral pressure guns force a special semi-plastic packing into the stuffing box.

Welded Steel Construction. Alemite lubricated cylinder-guided sleeve. Made also in conventional gland-pakt types. Write for Bulletin EJ-1907.

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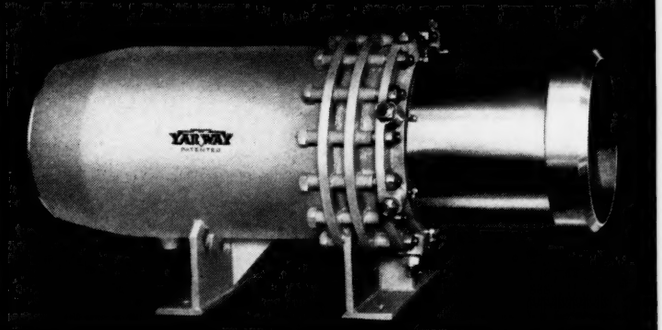
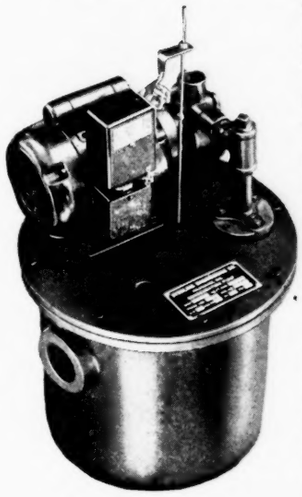
YARNALL-WARING COMPANY
104 Mermaid Ave. PHILADELPHIA



Prevents Costly Boiler Pitting..

STERLING "LOWBOY" CONDENSATION PUMP



This small, compact STERLING CONDENSATION PUMP saves you money. Avoids boiler pitting, saves installation of boiler return trap. LOW — in original cost and operating economy . . . HIGH— in performance and long-life efficiency. Has cast iron LIFETIME receiver, heavy duty float switch, special pump assembly — close-coupled, centrifugal turbine type. Only 1/6 H.P. Ball-bearing, brushless motor, never overloaded.

★ Write for Bulletin 340-D today on this inexpensive compact, efficient unit.

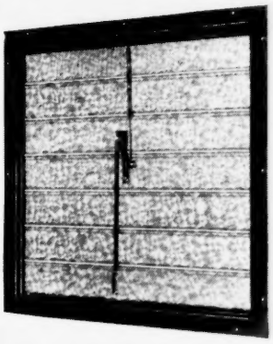
STERLING, INC.

3732-G N. Holton St., Milwaukee, Wis.

ELGO'S NEW PLANT to Meet the Ever Increasing Demand For:

Elgo Ventilating Specialties

New Counterbalanced Automatic Shutter



Made with louvres of steel instead of aluminum. New patented spring mechanism makes louvres open easier and wider, snapping closed when not in use. No flapping or flutter. Tension adjustable for different air velocities. Uniform movement of all louvres. The sensation of the year in the ventilating industry.

Write for circular and prices!

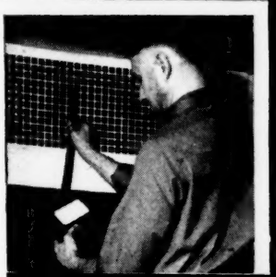
Shutters of All Kinds—Write for Catalog!

ELGO SHUTTER & MFG. CO.
6968 W. JEFFERSON DETROIT, MICH.

Free CATALOG

The All Purpose....

AIR VELOCITY METER



INSTANTANEOUS DIRECT READING
ASK FOR BULLETIN 2448D

Illinois Testing Laboratories Inc.

Don't Guess Know!

143 W. HUBBARD ST., CHICAGO, ILL.

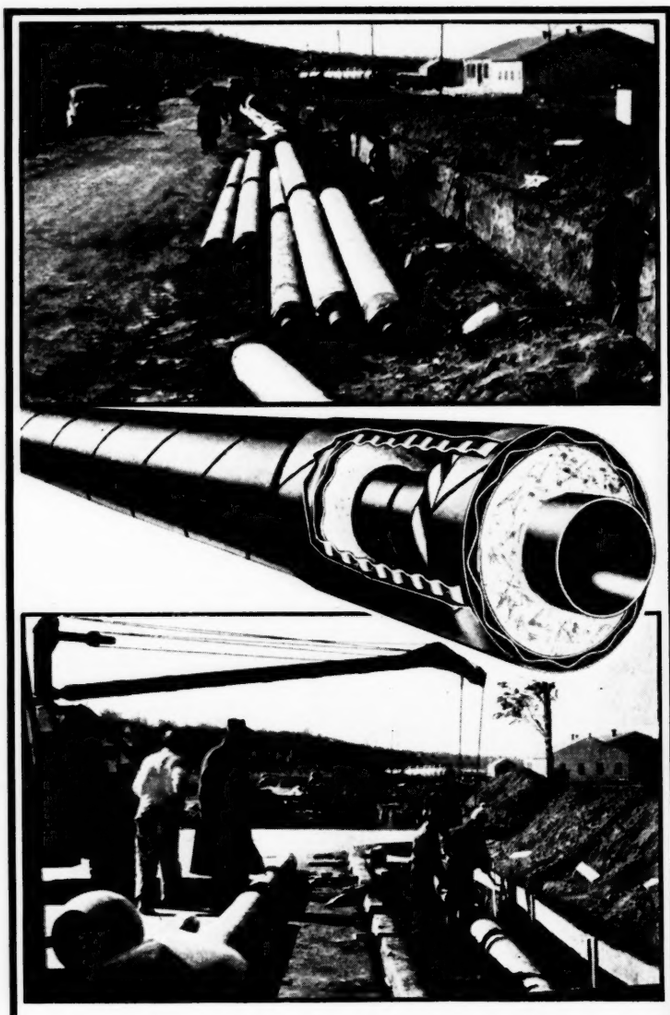
We Are Specialists—

Probably

WE CAN SHIP SOONER

SHELL AND TUBE CONDENSERS
BRINE COOLERS
PIPE COILS

ACME INDUSTRIES, INC.
JACKSON, MICHIGAN



RIC-WIL

INSULATED PIPE UNITS

"ON THE JOB"

AT BOLLING FIELD

Situated at Anacostia, D. C., four miles south of our National Capitol, Bolling Field has now become the new headquarters for the U. S. Army Air Corps. On this job 10,526 lineal feet of Ric-wiL Insulated Pipe Units with Dry-paC Insulation were installed for the protection of underground steam piping. This order was received by Ric-wiL on February 1st of this year, and by February 17th, or two days ahead of contract delivery date, shipment was completed. Our record on this outstanding project exemplifies the speed and competence which Ric-wiL is equipped to contribute to any defense problem involving underground steam distribution. Write for Brochure 4112 on Bolling Field installation.

The RIC-WIL COMPANY

CLEVELAND · OHIO

Agents in Principal Cities

Radiant Heat with Warm Air

(Continued from page 70)

grille placed near the ceiling. In the winter, we return all air near the floor, thus keeping the hall warm without any supply grille in it.

In two identical houses having identical heaters, one with conventional duct system, one "warm-floored", actual fuel bills as reported by the owners the past two years have been about $110 and $120 for the conventional duct job, $78 and $82 for the warm floor job. But the real story is in the grand comfort of the semi-radiant job, in contrast with the draftiness of the conventional on-off, low register, convection system.

Under simple air thermostatic control there is a remarkable self-compensating effect. As outside temperature lowers, walls and windows become colder, the floor, warmer, until the unit is running constantly at the design condition of, say, 0F. At this point, the fuel limit is being burned. If the temperature drops to — 10F, breathing line air will be at about 63F. You still feel comfortable, barefoot and lightly clothed, because the body cannot lose heat radiantly in the lower levels, as it does to the conventional "cold" (60F) floor.

It is my carefully considered opinion that the low-inside wall supply register with its hot and cold drafts, the low-outside wall return grille dumping a collection of bacteria, combustible dust and lint into unlined stud and joist spaces, coupled with an "on-off" blower delivering hot air through the short ducts — cool air through the long ducts, through a duct system requiring a velocity drop section followed by two short radius elbows to get into the joist space (instead of a properly sized transition opened adequately on top for the air to move out laterally almost frictionlessly)—the whole thing set forth in a pamphlet recently issued and purporting to classify this as an "A" system, as distinguished from "B" and "C" systems, is a shotgun prescription for the worst sort of a heating system.

EVERETT S. BUCK
FORT WAYNE AIR CONDITIONING CO.,
FORT WAYNE, IND.

NEW TRADE LITERATURE

Bellows. A standard size, 28-page catalog No. 130 on Fulton-Sylphon bellows and bellows assemblies. Catalog indicates the fundamental application of seamless metal bellows and describes both roll-formed and hydraulically-formed bellows in single and multi-ply types. The catalog discusses bellows metals, the action of bellows under load, their endurance qualities, and their life expectancy. It gives characteristics of brass, phosphor bronze, Everdur, Monel and steel bellows. THE FULTON SYLPHON COMPANY, KNOXVILLE, TENN.

Boilers. Four mailing pieces designed to illustrate the construction and design features of Fitzgibbons steel boilers. The pieces are intended for mailing at two-week intervals and each piece concentrates on one phase of construction. FITZGIBBONS BOILER COMPANY, INC., 101 PARK AVENUE, NEW YORK, N. Y.

Boilers. Four standard size catalogs illustrating and describing the Spencer line of steel tubular boilers

types, K, C, and A. First bulletin describes the Jacketed C oil burning boiler for home heating and automatic domestic hot water. This boiler is available in 8 sizes from 700 to 1950 sq ft steam radiator surface. Second bulletin describes the Jacketed C stoker boiler which is available in same sizes and capacities as Jacketed C oil burning boilers. Third bulletin illustrates and describes the Jacketed K boiler which can be used with either oil or stoker firing and is available in three sizes with capacities ranging from 400 to 600 sq ft steam radiator surface. The fourth bulletin illustrates and describes the Streamlined A All Fuel boiler which is available with capacities from 1800 to 42,500 sq ft steam radiator surface. SPENCER HEATER DIVISION, AVIATION MANUFACTURING CORPORATION, WILLIAMSPORT, PA.

Valves. An 8-page illustrated bulletin featuring the company's superfinished 500 Brinell bronze valves. Bulletin describes application of superfinish operation to the manufacture of bronze valves. THE HANCOCK VALVE DIV., MANNING, MAXWELL & MOORE, INC., BRIDGEPORT, CONN.

Propeller Fans. Catalog No. 141 which explains by diagrams and actual installation photographs the term "Vitalized Ventilation". This phrase is designed by Ilg as air change, not just air movement. Specifications for the complete line of Ilg products are given together with illustrations including diagrams and installation views of propeller fans, automatic shutters, fan guards, power roof ventilators, dark room ventilators, special high speed fans, portable floor fans, night cooling fans, kitchen ventilating fans and volume blowers. Also contains information on Ilg direct-connected Universal blowers and shows how Ilg fans are rated and certified. ILG ELECTRIC VENTILATING CO., 2850 N. CRAWFORD AVE., CHICAGO, ILL.

Expansion Valves. A sales manual designed to help jobbers and salesmen to better present the story of A-P dependable expansion valves. This book has transparent pages which makes it possible to easily present the features of construction and advantages of this line of valves. Manual also contains necessary technical data and confidential prices on all refrigerant controls, so that it is a sample kit and sales manual put together in a small easy-to-handle book. AUTOMATIC PRODUCTS COMPANY, 2450 N. 32ND ST., MILWAUKEE, WIS.

Corrosion. A 6-page folder illustrating and describing the Pressure-Jet system for conditioning steam heating systems to prevent corrosion. System is said to remove scale, corrosion, rust or oil from steam heating systems in old buildings and protect expensive heating systems in new buildings from deterioration. PRESSURE - JET CORPORATION, 631 E. CENTER ST., MILWAUKEE, WIS.

Refrigerating Condensers. A standard size, 12-page bulletin, C-1100-B13 illustrating and describing the Worthington-Carbondale shell type condensers and coolers. Gives information on construction, outstanding features, and applications of these shell type condensers and coolers designed for refrigeration service, ice manufacture and air conditioning. Includes a number of photographs of installations. CARBONDALE DIVISION, WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

Water Treatment. A standard size, 12-page booklet which describes the chemistry of feed water treatment and gives the fundamental reactions involved in water treatment which would be helpful in interpreting water analysis. COCHRANE CORPORATION, PHILADELPHIA, PA.

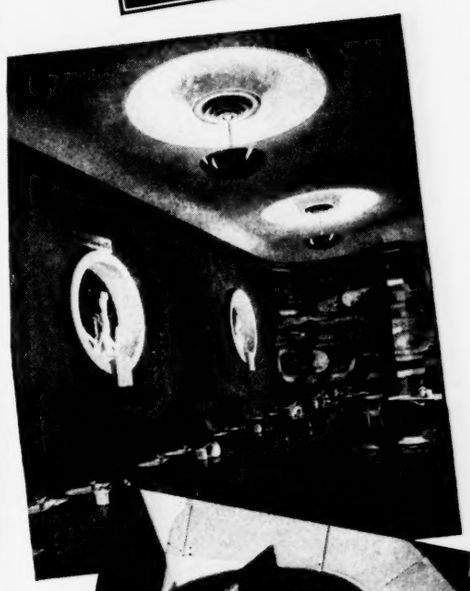
Engineers Recommend
ANEMOSTATS
For Leading Installations
To Assure the Ultimate In
DRAFTLESS
AIR DIFFUSION

ENGINEERS throughout the industrial world realize the extreme importance of faultless air distribution.

This accounts for the wide usage of ANEMOSTATS, Draftless Air Diffusers, in foremost factories, offices, theatres, stores, etc.

Faultless Air Distribution means draftless distribution of the heated, cooled or ventilation air, the equalization of temperature and humidity and the prevention of stale air pockets in which the air is either too hot and too dry, or too cold and too humid.

If you have faulty air distribution, the *objectionable conditions are definitely overcome by the use of* ANEMOSTATS.



ANEMOSTATS can be installed inexpensively and quickly and are ideal for use on new or existing installations.

ANEMOSTATS produce these unparalleled results because they are the only air diffusers which operate on the following interdependent principles:

1 **Air Expansion within the device, which reduces velocity instantly**

2 **True Aspiration, which causes room air to be drawn into the device where it is mixed with the supply air.**

3 **Creation of a multiplicity of air currents and counter-currents at low velocities, which causes slow but adequate secondary air motion.**

ANEMOSTAT
CORPORATION OF AMERIC
10 East 39th Street . New York, N.

REPRESENTATIVES IN PRINCIPAL CITIES

A Word About Deliveries:

Recently about 70% of our production facilities have been taken for Defense Work — Aircraft, TNT, Small Arms Ordnance, Bomber Assembly, Aircraft Engine Plants, Army Cantonments, Hospitals, Research and Experimental Laboratories — a veritable Roll Call.

Last month we extended our explanation and apology for the inevitable results on non-defense orders. Now relief seems ahead. Despite many difficulties and unexpected delays our new building is nearly completed and will soon give us increased facilities.

OUR PROMISE:

To the extent mandatory priorities, restricted materials, and limits of human endurance allow, we pledge ourselves to render the very best service our experience, skill and resources will permit.

Meanwhile, may we again ask your patience and forbearance.

MARLO
COIL COMPANY
6135 Manchester Ave., St. Louis, Mo.

Manufacturers of
HEAT TRANSFER EQUIPMENT

Controls. A single page standard size engineering bulletin No. 102 describing the Worner electric eye which is designed for detecting smoke in air conditioning and ventilating systems. WORNER PRODUCTS CORP., 1019 W. LAKE STREET, CHICAGO, ILL.

WITH THE MANUFACTURERS

Paragon Electric Company, Chicago, Ill., has moved its manufacturing facilities from Manitowoc to Two Rivers, Wis. At the new location the company has a modern brick and concrete building with 25,000 sq. ft. of floor space, double the area formerly occupied. Executive headquarters of the company will remain in Chicago at 37 West Van Buren St.

Sampsel Time Control, Inc., has constructed a new 24,000 sq ft building nearing completion at Spring Valley, Ill., duplicating the original Sampsel building.

Macrae Incorporated has changed its name to *H. J. Hueller Manufacturing Co., Inc.* The company will continue to manufacture Twin Control oil burners and boiler-burner units. *H. J. Hueller* remains as president. The company will shortly move into new and larger quarters in its own building at 559 Rogers Avenue, Brooklyn, N. Y.

Spray Painting. A standard size, 28-page catalog 1E covering in condensed form the complete line of DeVilbiss standard spray finishing equipment for industrial use. Includes information on DeVilbiss exhaust fans and spray booths. DEVILBISS COMPANY, 300 PHILLIPS AVE., TOLEDO, OHIO.

Air Devices Inc., 17 E. 42nd St., New York, manufacturers of air distribution and control devices, has announced, through C. N. O'Day, secretary-treasurer, that it is now represented nationally by direct sales representatives in 44 U. S. cities, as follows: Tucson; Indianapolis; San Francisco; Los Angeles; Pittsburgh; Toledo; Minneapolis; Buffalo; Cincinnati; Salt Lake City; Seattle; Kansas City, Mo.; Houston; Denver; Aurora; St. Louis; Tulsa; Dallas; Des Moines; Detroit; Portland, Ore.; Milwaukee; New Orleans; Scottsbluff, Neb.; Bozeman, Mont.; Cleveland; South Bend; Reno; Syracuse; Washington; Union, N. J.; Wyoming, Pa.; New York City; Philadelphia; Baltimore; Albany; New Haven; Richmond; Cambridge; Jacksonville; Charlotte; Birmingham and Atlanta, and also in Toronto, Canada.

Whiting Stoker Company, 4711 W. North Avenue, Chicago, Ill., has added a new two-story concrete brick building and a second floor on the present one-story building in order to increase the capacity of its plant.

The factory and warehouses of *Viking Air Conditioning Corporation,* 9500 Richmond Ave., S.E., Cleveland, Ohio, were destroyed by fire June 23. Originating in a paint spray booth the fire rapidly spread throughout the entire building which was demolished within one hour. Fortunately, the adjacent office building was saved and most of the company records were not damaged. Temporary manufacturing facilities were arranged for and the company is putting forth every effort to supply its customers with minimum delay.

The Herman Nelson Corp., Moline, Ill., announces the purchase, on July 1, of the assets and business of The Autovent Fan & Blower Co., Chicago. The business will be operated as The Autovent Fan & Blower Division of The Herman Nelson Corporation. The Autovent products will continue to be manufactured by The Autovent Division in Chicago. Included in the

Autovent line are a complete range of sizes of centrifugal blowers from 6 to 72 in. in diameter in both forward and backward curved blade designs and a propeller exhaust and ventilating fans from 12 to 72 in. in diameter.

PERSONALS & PERSONNEL

F. H. Dryden

Francis H. Dryden was recently appointed to the post of Assistant Work Projects Administration Commissioner in charge of all construction projects. One phase of WPA operations under his direction currently includes the building, extending or improving of 300 airports and airfields. At Fort Riley, Kansas, expansion work includes the construction of 27 mess halls, three administration buildings, two hospitals, road reconstruction and the building of utility lines. WPA work already completed there includes the reconstruction of 45 barracks, 17 garages, 141 officers' residences and four schools. Mr. Dryden was captain in the Corps of Engineers, U. S. Army, during the first World War and prior to that he was a construction engineer for the Pennsylvania Railroad. Later he was assistant general superintendent of the Niagara Falls Power Company and then was a private consulting engineer specializing in municipal engineering.

Howard E. Johnson has been appointed operating manager of the Metropolitan distributing branch of the General Electric Co. in New York handling radio, appliance, heating and air conditioning lines, is announced by Earle Poorman, manager. Mr. Johnson succeeds *P. L. Griffin*, who is leaving the company to accept an executive position in Chicago.

Mr. Johnson has been with G.E. since shortly after his graduation from Ohio State University in 1926. He began with the General Electric refrigeration department in Cleveland in 1927 in the early days of the organization of the department.

Paul B. Zimmerman has been appointed vice-president and general sales manager of *Airtemp Div., Chrysler Corp.*, Dayton, effective June 24. At the same time, Mr. Zimmerman announced his resignation as vice-president and treasurer of Grace & Bement, Inc., Detroit advertising agency.

T. A. Marsh

T. A. Marsh, nationally known combustion engineer, has been made national industrial engineer at the Cleveland plant of *Iron Fireman Manufacturing Company*. Mr. Marsh was formerly located in Chicago as central division engineer for that company. Mr. Marsh joined Iron Fireman in 1934.

H&V'S PHOTOS

Page 25—American Petroleum Institute, New York.
Page 31—University of Michigan, Ann Arbor, Mich.
Page 34-36—American Air Filter Co., Louisville, Ky.
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Industrial and Commercial
OIL BURNERS
for
Better Performance · Lower Costs

DISTRIBUTORS IN ALL PRINCIPAL CITIES

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Type 513 Single Speed Fan Control. Range 100° to 300° Fahrenheit.

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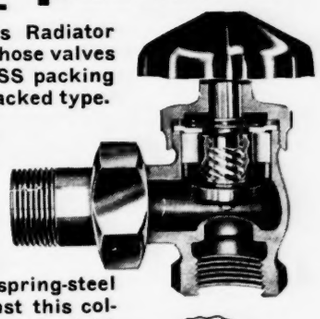
how easily you can install White-Rodgers Hydraulic-Action fan and limit controls. Positive, accurate performance assured, regardless of position. Easy-to-read dials permit exact setting of cut-in and cut-out temperatures. Write for White-Rodgers Control Catalog today!

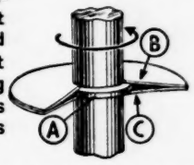
WHITE-RODGERS ELECTRIC CO.
1207 CASS AVE. • ST. LOUIS, MO.

One packless valve that IS packless

THE Marsh Packless Radiator Valve is not one of those valves that simply require LESS packing than the conventional packed type. Instead it has a unique metal-to-metal seal that is PERMANENTLY LEAK-PROOF.



The diagram tells the story. A collar (A) is machined on the stem. Two stainless, spring-steel wafers (B) press against this collar as shown to form a tight annular seal against the upper and lower faces of the collar. Does it work? Yes, it has been working perfectly for thirteen years — has proved to be the greatest packless design ever developed.



Marsh Packless Valves are available in all patterns and finishes. The same packless type of construction is also available in Marsh "Renewal Bonnets" for converting worn out valves into modern Marsh Packless Valves. Write for bulletins.

JAS. P. MARSH CORP.
2089 Southport Ave., Chicago, Ill.

MARSH
HEATING SPECIALTIES

Manufacturers of quality air valves, venting devices, gauges, traps, valves and thermometers since 1865.

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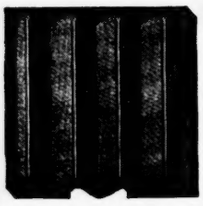

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Where Somers Hair Spun Glass Filters are installed as original or replacement equipment there's an end to the cost. Somers Filters are washable, odorless, non-absorptive, do not rot, and are practically indestructible.

Dust, dirt, pollen and detritus in the air stream effectively removed with minimum back pressure. No adhesives required.

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Somers Filters may be cleaned easily by using the stream from an ordinary water hose (at city pressures) pinched to obtain a spray effect.

For complete details and prices, write giving the c.f.m. per unit and dimensions of present master holding frame. A few choice territories are available for representatives. Full particulars on application.

H. J. SOMERS, INC., 6065 WABASH AVE., DETROIT, MICH.

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For checking heating plant operation and predicting fuel consumption. $3.

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Fundamental principles of air conditioning, equipment and systems in use. $3.

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Supplies and Equipment, we have 12 big warehouses to serve you.

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UNIT HEATER AGENTS WANTED, McCord Radiator & Mfg. Co., Detroit, who manufactures a complete line of unit heaters, blast coils, and cooling units, has openings in a number of territories for agents. McCord unit heaters are a modern, quiet unit—are engineered and backed by thirty-four years heat transfer experience. Established policy. Address: Manager, Unit Heater Division.

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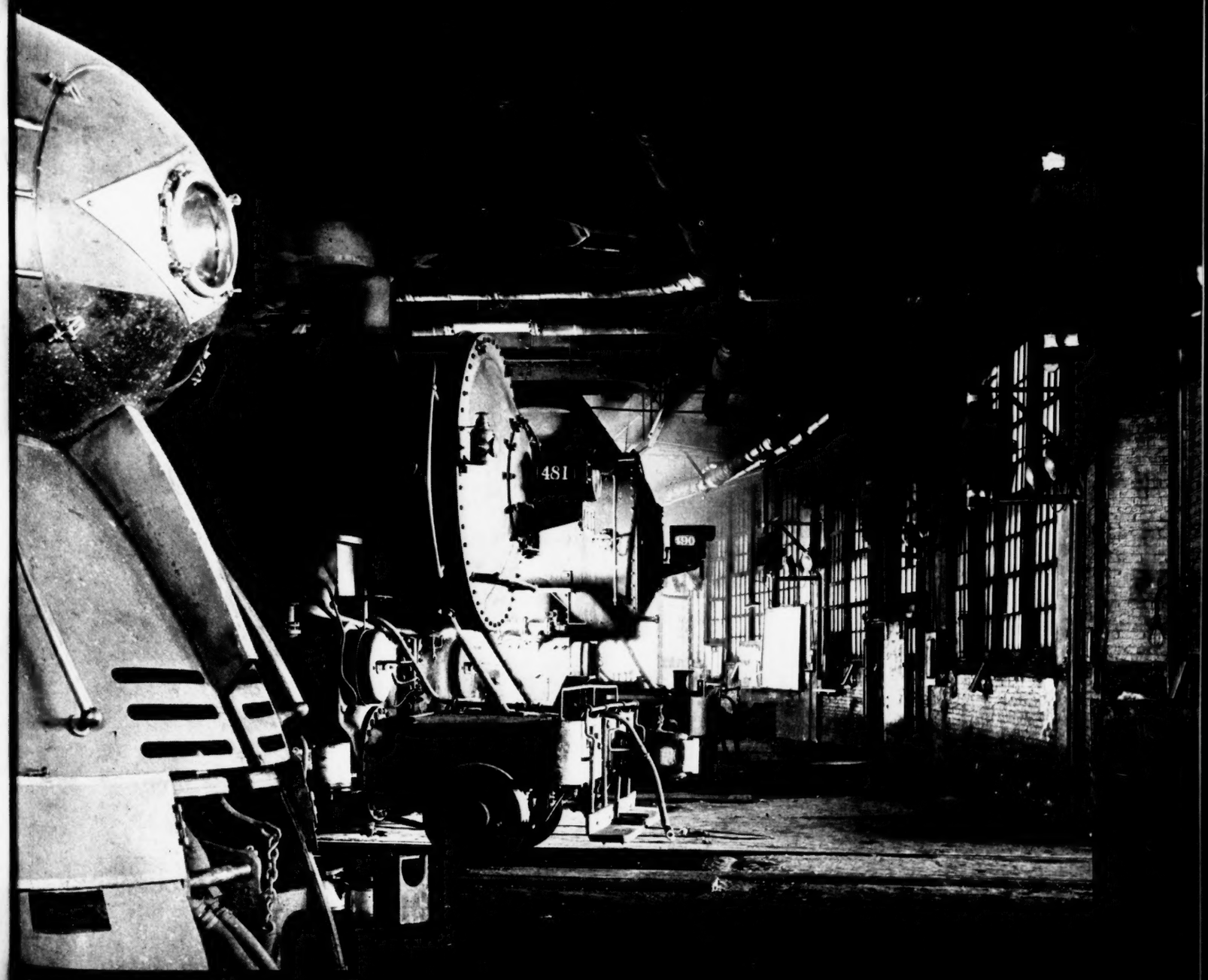
The Air Conditioning Monthly